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ELECTRICAL COMPANY FINANCING.

AT the time of the electric lighting panic in 1882, when central station lighting—we might almost say installation lighting—was in its infancy, the general public was so dazzled by the brilliant future predicted by the promoters of the electric lighting schemes that people immediately took up shares in the companies then being formed without giving any thought as to the practicability of the projects. The promotors of the various schemes described in such glowing terms what handsome profits would be realised, that the intending shareholders did not for one moment hesitate to invest their money, feeling convinced that all would be well, especially as the projects were supported by the daily press and even by some so-called technical journals. What was the result? After a certain time had elapsed and the enthusiasm of many persons had somewhat cooled, the shareholders of the various companies were suddenly startled by the report that everything was not all right. Strict investigations were then made, and it was found that thousands upon thousands of pounds had been paid away as the purchase money for different patents which turned out to be of no value whatever, and that considerable sums had also been expended in fruitless experiments. This discovery came like a clap of thunder upon the shareholders, who then for the first time learned that their investments consisted of a few worthless specifications. The result of this state of affairs was that a serious panic took place, the companies mostly went into the bankruptcy courts, and the shareholders lost all their money, many persons being ruined. For some four years subsequent to the events just enumerated, it appeared as if both public and private individuals could never forget the lesson which they had been taught. In the meantime, however, electrical engineers had devoted considerable time and money in making experiments for the purpose of increasing the efficiency of dynamos and batteries and in improving every apparatus, and, in fact, everything employed in electrical operations. Consequently it became possible to put up installations in both a safe and economical manner, and the result of this was that towards the end of 1886 the confidence of the public began to return, and it has ever since been gradually on the increase. This has been demonstrated by the fact that during the years 1887 and 1888 considerable sums of money were invested in electrical companies, and that a great development in electric lighting took place.

Let us now turn our attention to the present year and we shall find that one of the most striking features in the electrical engineering industries has been the number of new companies registered in London for the supply of electric light and power and electrical machinery and accessories. During the first six months of this year there were registered for these purposes no less than 52 limited companies with a total share capital of £3,813,600. The largest share capital of an individual company was £500,000, and the smallest £1,000. The number of companies registered during the corresponding period of 1888 was 45, showing an increase of seven for the current year. The aggregate share capital for the first six months of last year was, however, the enormous amount of £22,254,000, being nearly six times more than that for this year. This large sum, however, comprised two companies registered with a capital of £10,000,000 each, so that if we omit these two—which, we believe, were not floated—an increase in capital of over £1,559,600 is shown for the first half of this year as compared with the first half of 1888. Now, as far as we have been able to ascertain, not more than one-half of the companies registered this year have been floated; and, indeed, when the variety of objects for which certain companies were to be formed is considered, it is not surprising that the efforts of the promoters have been futile. Nevertheless, we are glad to find that throughout the United Kingdom there is an increasing desire on the part of the municipalities, manufacturers and private individuals to be supplied either with electric light or power or with both. We must, however, raise our voice to protest against the wholesale company-mongering which during the last few weeks has seemed to take a prominent position in what may be termed the electrical company promoting world. Company after company has been registered at Somerset House, and the names of most, if not all, of the first subscribers (who invariably take the stereotyped one share and who are to be the first directors), are generally well known—not to the public or the electrical profession, but only to each other. Whenever we come across the prospectus of such companies, we invariably look with suspicion upon the promoters or signatories, who, in some instances, are clerks and others with no technical knowledge. It may be argued that no technical knowledge is necessary in starting and carrying on an electrical company, for the simple reason that the directors can easily arrange with a contractor to do the necessary installation work. That may be, but with practical electrical engineers as directors and who would no doubt attend to all installation work, the profit of the contractor, which is no inconsiderable sum, would be saved. If a ship is not well captained and manned, some terrible disaster generally takes place, and with electrical companies the same condition of affairs holds good. Therefore we would advise our readers before taking up shares in companies, to thoroughly investigate the *bona fides* of the undertakings in which they intend to invest their money.

Mr. Chas. F. Heinrichs, who some years ago was well known in electrical circles here by his inventions in dynamos and arc lamps, has been interviewed by enterprising American pressmen on the subject of executing criminals by electricity, or, as it is now called, electrocution. The *Star*, not our bright London luminary, devotes more than a column to the pregnant remarks of Mr. Heinrichs who discusses in a very able manner the absurd notions which are prevalent in the States regarding the dangers to be apprehended from electric shocks. Opponents of electrical execution make a great point of the suggested uncertainty of the current's action, and quote the fact that even lightning does not always kill. But, as Mr. Henrichs very justly remarks, nature's laws are not to be bought over to serve speculative purposes. Lightning does not prepare human beings to deliberately kill them, and when death does ensue the victim must have been directly in the path of the discharge. These people seem to imagine that it is intended to use electropathic treatment or static charges for the purpose, instead of a high tension alternating current electric light machine which will assuredly perform its ghastly duty effectually and painlessly, although the *Electrical Engineer*, of New York, doubts whether the electric current will invariably kill without mutilation or disfigurement of the body. Public sentiment has been too much worked upon by would-be protectors of the sacred electric current, who insist that it is degrading to employ electricity for sending murderers into eternity. One might, with quite as much logic, deplore the rope making industry because the noose is universally employed in the United Kingdom to perform the same duty. Probably by the date of our next issue all doubts as to the first trial will have been set aside by the execution of Kemmler at Auburn prison.

The remarks on another page attributed to Mr. F. L. Pope, the well known American electrician, give a fair example of how necessary it is to be able to distinguish between half truths and whole truths. He says "it is admitted that lightning is less fatal to man than to the lower animals." We would like to know the man who, having studied the subject, is prepared to make the admission. Mr. Pope must confess that the conditions under which men and animals exist are so utterly different that the comparative immunity of human beings from lightning fatalities is at once explained. We are more or less protected in big townships, and can make ourselves comparatively safe even in the country, but cattle, from the very nature of their surroundings, are generally at the mercy of lightning strokes. Can Mr. Pope give any instances of cattle being killed by lightning in towns? In England at all events we hear of an occasional human victim in great cities, but we cannot recall an instance of a horse being struck. Mr. Pope's evidence on this point, and, indeed, throughout, appears to indicate a desire to give only half truths, but we do not think that Mr. Brown's testimony will be much shaken by such utterances.

In our report of the Anglo-American Brush Company's meeting it will be noticed that Mr. Lane-Fox is dissatisfied with the caving in of that company to the Edison and Swan Company. He proposes to commence the manufacture of lamps forthwith, and if he can see his way to assure those who might be disposed to purchase as to their immunity from legal interference, there is no doubt that he would, at reasonable rates, secure a good business.

Among the numerous sights which it was the privilege of the Institution of Mechanical Engineers to see during their stay in Paris none could be more interesting than their visit to the Bon Marché, where they were taken ostensibly to view the electric light installation, which is fitted up in the basement of that vast establishment, but, as every detail connected with the business is so worthy of attention, the electrical arrangements must have formed only a comparatively small centre of attraction. The electrical plant, which is very complete, and furnishes current for 300 arc lights of 9 ampères on the ground and first floors, and outside the building, and 100 Jablochkoff lights, as well as 3,000 glow lamps in different parts of the establishment. The first installation laid down consisted of four Belleville boilers, a pair of horizontal engines of 200 horse-power, and two others, all of the Corliss type, driving by belting some 36 dynamos. This not proving sufficient power, a new installation has been more recently laid down. In consequence of the nature of the soil the room to contain the machinery had to be constructed as a water-tight compartment of rivetted iron plates. The engine power is furnished by four Corliss condensing engines of 150 horse-power each, while a battery of seven Belleville boilers supply the requisite steam. The ventilation of this part is secured by a rotary fan driven by an electro-motor. The increasing use of electrical apparatus, lifts, and other labour-saving machinery, in establishments keeping up to the requirements of modern civilisation, renders it necessary to have a staff of qualified men to superintend the machinery and to do repairs. In the Bon Marché the mechanical departments are under the control of an engineer of skill and experience. It might have appeared strange to the last generation that one of the most important men on the staff of a linen draper's shop should be a qualified engineer, although even in those days we believe there existed a lady y'clept the "dark girl dressed in blue" who was dubbed chief engineer in a milliner's shop.

AT the half yearly general meeting of the Metropolitan Railway, last Friday, a shareholder inquired whether there was any chance of their having electric traction on the line. The chairman, in reply, said, with regard to electric traction, the board had concluded an arrangement by which a very important experiment would be made at the expense of the inventor. The arrangement with Lord Bury's company did not come to anything. A good many experiments were made, but they found afterwards that they were made on wron principles. Now the history of this little matter is about as glaring an example of folly as can well be imagined. At the time of its inception the scheme was condemned and the reasons for this course given in our pages. If inventors, and financiers, too, for that matter, paid more heed to the warnings of the technical press what vast sums of money now wasted might be utilised for some good purpose. Lord Bury should in course of time learn wisdom.

THE London edition of the *New York Herald*, in its description of the river illuminations at Richmond last week, goes into transports of rapture over Immisch's electric launch the *Viscountess Bury*. This remarkable vessel threaded its way among the smaller craft with ease and "graceful speed," whatever rate of progression this may mean; and ladies being on board there was a merry time—flying corks and foaming champagne. Mr. Richardson, of tramway renown, who was on board, predicted a great future for electromotive power, and said that he would soon have his numerous tram lines running electric cars. To those who are aware of the part which Mr. Richardson has already played in electric locomotion, these remarks will appear passing strange, but perhaps the *Herald's* reporter did not quite "catch on;" in any case the power of champagne *pro tem.* is wonderful, although, fortunately or unfortunately, it is very evanescent.

DURING the first week of this month a number of accidents, luckily not fatal, occurred in New York through overhead electric light wires. The shocks received were in most instances sufficient to produce unconsciousness. One of the city dailies, in commenting upon these and similar incidents, says:—"The present state of affairs is intolerable, and with the extension of the electric light system, it is daily growing worse instead of better."

AN American patent is usually considered to have more value, in a marketable sense, than the majority of European patents, for the reason that before granting patent rights in the States the Patent Office Examiners are supposed to make a search as to prior publication, so that when patent rights are granted the validity of the same may not be called in question. The Examiners must sometimes make a very poor search. As an instance in point, a patent was issued to T. C. Kauffer in 1885, for the use of bichromate of soda as a depolariser; on the strength of that a company was formed to buy the patents. Next comes on the scene an English patent for the same material and application, granted in 1882. The company, to gain control, had this latter patent assigned to them. Later on both these were declared invalid on account of another English patent, dated 1871, which had expired, and in consequence the right to use the material in contention was in reality public property.

IN a note to *Nature*, Mr. Alexander McAdie, of New York, gives an interesting explanation of the peculiar tingling electrical sensations observed by surveying parties and others on high peaks and slopes in the western part of America, sensations which were relieved when a flash of lightning took place. In some experiments made at the top of the Washington Monument, which is 500 feet high, it was found that on the approach of a thunderstorm the difference of potential between the top of the monument and earth rose steadily up to several thousand volts, and then suddenly dropped to zero simultaneously with the lightning flashes, the latter evidently relieving the state of stress of the air.

MR. GEO. M. HOPKINS has a sensible piece of advice tacked on to an article by him in the *Scientific American*. The article relates to the manufacture of Planté secondary battery cells and their formation; it concludes by telling amateurs "that, although they may find pleasure in constructing and forming a secondary battery, there is no economy in securing a battery in this way. It is less expensive and less vexatious to purchase from reliable makers."

OUT of a total of 1,258 deaths which were caused by accidents last year in New York City, five only were through electric currents, while illuminating gas was answerable for the death of 32 people at least, who are tabulated as having been killed by suffocation or poisoned.

DR. GEORGE HERSCHELL has fallen foul of the Institute of Medical Electricity, Limited. In a lengthy letter to the *Illustrated Medical News* he describes this Institute as having sunk to the level of the several electrical quacks whose advertisements flood our daily papers, and as entering the lists as a competitor. Mr. H. Newman Lawrence takes up the cudgels on behalf of the Institute, which he was mainly instrumental in forming, and endeavours to show that the original programme is in no way departed from, and that the worthy doctor is mistaken all along the line. Those who desire to follow the controversy and form their own opinions—and probably Profs. Ayrton, Fleming, Hughes, Thompson, and others whose names are mentioned, may be interested in the discussion—we refer to the issues of our contemporary for July 13th and 20th.

IN a Welsh province a Committee has been formed with a view to forming an electric light company, and we have been politely requested to give the committee the necessary information to enable them to proceed. Now, although our good nature is limitless, there are only a given number of hours in a day, and if we were to answer all the questions which are put to us it would be necessary to stay in our editorial sanctum to the end of all time, and to engage the services of some "Admirable Crichton," who combined in himself the necessary qualifications of town clerk, solicitor, borough engineer, electrician, Board of Trade official, Parliamentary agent, and patent expert. Much as we would wish to serve our friends, we would submit that the town clerk or the solicitor to the Town Council would be the proper persons to advise the Welsh Committee in their laudable desires. Or let the Committee procure the Electric Lighting Acts, a copy of a provisional order, and the Board of Trade Reports, the enquiry leading up to which was published in the REVIEW.

NOTES FROM GERMANY AND FRANCE.

[A COMMUNICATION.]

THE great electrical company of Berlin, the Allgemeine Elektricitäts Gesellschaft, has decided upon increasing its capital from £600,000 to £800,000. This increase has become necessary in consequence of the extensive business which the company is undertaking in Germany, Austria, France, Italy, and even America.

At the late electrical exhibition in Munich, the firm of Messrs. Schuckert and Company, of Nuremberg, was the best represented. Their plant consisted of a turbine of 150 horse-power, working four dynamos driven by a current from the river Izar. On account of the slow moment of the turbine, no regulator between the latter and the dynamo was needed. Two of the machines, of 110 volts each, were compound dynamos with rheostat and shunting coils. By this installation the whole of the industrial section and the gardens were illuminated with glow and arc lamps.

A Berlin electrical engineer, Herr H. Welcker, has invented a new accumulator, the construction of which is, however, a great secret, although experts declare it to be the most advantageous yet invented. A company has been formed with a capital of £100,000 to work the invention. The accumulators are to be charged in a factory to be built, forwarded to the consumers, and fetched for refilling. The company anticipates particularly to do business in parts of Berlin situated far from the central electrical stations; as, for instance, the south west.

The first central electrical station has just been opened in Hamburg, and is working most satisfactorily. The station, which has been established by the city, has cost £500,000, and is capable of feeding 10,000 glow lamps, all of which have already been subscribed for. The light is particularly used in the neighbourhood of the Binnenalster, viz., in the busiest squares and thoroughfares. Another station is in course of erection at St. Pauli, the harbour quarter, where the National Theatre and other pleasure resorts are situated. The electric light is, however, not intended to entirely supersede gas, as the city is still its own gas producer.

The well-known firm of Siemens and Halske, of Berlin, has recently invented an electrical signal apparatus of great merit for warning persons at railway crossings of an approaching train. When the train is some 1,500 yards from the crossing, contact between the wheels of the locomotive and an electric wire sets a bell ringing at the crossing until the train has passed.

Some recent experiments with the telephone in field operations of the Prussian Guards have proved highly satisfactory, and the instrument is to be adopted for permanent service. On the other hand, electric night signalling has been carried out in the German Navy by means of glow lamps. The latter are fixed in the foremasts, 3·5 metres apart, and are three in number, with white and red lantern slides which may be illuminated at will by the electric light. By manipulating the colours ten signals are obtained, corresponding with instructions in an agreed code.

The electric light in that part of Berlin, which is the centre of the business portion of the German capital, has of late developed in an unexpected degree, as anyone visiting this part will observe. The central stations, which belong to the Berlin Electricity Works, and which supply the light, have also been much enlarged of late. Since the first established station has been enlarged to furnish a force of 1,200 horse-power; and connected with station No. 2, the brilliantly illumined thoroughfare Unter den Linden has been lighted. These two stations have at their disposal a force of 3,900 horse-power, and are capable of feeding 40,000 glow lamps. In addition, two more stations are in course of erection, which will be ready next autumn, each possessing 2,000 horse-power, and whereby the power of the works will be doubled.

It is further contemplated within the next few years to enlarge the two new stations, as well as the old one, with 2,000 horse-power each, when in some three years' time there will be 14,000 horse-power at disposal, capable of feeding 150,000 glow lamps. The development of the Berlin Electricity Works is without parallel in Europe. In one part of the city alone there are now more electric lamps than gas lamps, and still gas has not been entirely superseded, but the requirements of light have been doubled. Efforts are also being made to employ electric motors on a larger scale, these being now chiefly used for minor work, as, for instance, lifts, ventilators, sewing machines, &c. When electricity has attained a more general use, the central stations, which are now for lighting purposes only worked a comparatively short time diurnally, may be utilised to a more profitable extent, and the cost reduced. However, much has already been accomplished in this direction. For instance, the stations have been connected, so that it is now possible in the daytime or in the summer when the consumption is small, to light the whole district from one station, whereby great saving of coal and labour is effected. The two new stations are to be connected in a similar manner, and here a further reduction of cost is estimated by the employment of machinery of 1,000 horse-power each. Besides, naturally, it may be expected that as the stations are increased, the cost of the electric light and motive power may be lessened.

From statistics just published of the telegraphs of Germany, it appears that they comprise 272,224 kilometres, as against 261,350 in the previous year, with 9,500 stations, as againt 8,841. The receipts were respectively in the two years, £9,450,000 and £8,950,000, and the expenditure £7,900,000 and £7,600,000, leaving a profit of £1,550,000 and £1,350,000. With extra expenditure in material amounting to £210,000 and £200,000, the actual profit is respectively £1,340,000 and £1,150,000.

It is stated in St. Petersburg that a powerful syndicate is in course of formation for the laying of a telephone line from Paris to the Russian capital, *viâ* Berlin, Moscow, and Warsaw.

A curious electrical dispute has just been decided at Tours, in France. An electrical company in that town had run a wire across a householder's roof, without, however, its being fixed thereon in any way. To this the latter objected, maintaining that the space above his house was his, to a reasonable height, for any such purpose as he might utilise it; that the wire, if falling, might cause damage, and that, finally, its vibration of a night in wind disturbed sleep. The company, on the other hand, claimed that the plaintiff had no right to the air above the house. The Court held, however, that the plaintiff was entitled to having the wire removed.

In the central electrical station established by the French Edison Company in Palais Royal, in Paris, experiments are being made with an electrical meter constructed by an engineer, M. Billie. The principle of the apparatus consists in its not only recording as an ordinary wattmeter the number of watts (volts × ampères) consumed, but also the time occupied in the consumption. The apparatus consists of five parts, viz., (1) an electro-dynamometer, which measures the product of the electromotive force and strength of current; (2) an electro-motor whose action is transmitted to the clockwork; (3) a regulator; (4) a clockwork which records the time between two measurements; (5) an apparatus which records the consumption of watts in a given time.

Recently, in the Théâtre de Renaissance, in Paris, one of the spectators experienced a disagreeable surprise on happening to come in contact with a non-insulated electric wire. Now the municipal authorities have directed that all wires in public buildings shall be insulated.

Recent experiments in various countries with submarine vessels have practically demonstrated that the difficulties which arrested progress some 20 years ago have been overcome. Referring to this subject in a recent paper to the Academy of Sciences in Paris, M. Ledieu, the well-known engineer, says:—"At first, it was considered that compressed air might be used in the propulsion of small vessels, but as it was found that freezing affected the machinery lubricant, water heated to a temperature of 195° was tried, but this also failed, owing to the great weight and volume of water. It is now, however, after M. Gymnot's remarkable and successful attempts at Toulon, clear that the problem of submarine navigation is to be solved by electricity. In these trials accumulators were used. The weight is far below that of water, and it remains constant. In case of accumulators about 37 kilos per horse-power an hour is required, which does not exceed much the corresponding weight when compressed air is used. M. Renard's light chloric chromium elements do not weigh quite half as much as the accumulators. Besides, the dynamo machines are lighter than any other motors—at all events, for smaller vessels.

At a recent meeting of the said Academy Dr. Terré gave an interesting description of a woman who showed herself electric in a very peculiar manner. When, for instance, she touched a knife a spark would appear between the latter and the hand, and persons shaking hands with her often sustained an electric shock. Dr. Terré, being unable to explain this phenomenon, applied to Dr. Arsonval, a specialist, and this physician came to the conclusion that the phenomenon was due to a very dry skin, to be compared with India-rubber, which, when rubbed, becomes charged with electricity. The woman in question belonged to a family suffering from hereditary nervous affliction, and the electrical phenomena became manifest at the age of 15, and attained their greatest intensity when 27 years of age. At that period her fingers acted like a magnet upon smaller objects. The electricity increased in dry and cold weather. The woman has a son, 11 years of age, who hitherto had shown no abnormal state, but lately a similar phenomenon has become manifest in respect of him also.

The French Government has decided upon taking over and working all the private telephones in France.* In Paris the telephone has hitherto been worked by a company, which in 1879 obtained a monopoly for five years, renewed in 1884, and which therefore expires in September next. This company had proposed to the Government to retain the monopoly for another 35 years, when the lines were to be handed over to the State gratis, but the Chamber having rejected this offer, the Government proposes to buy up all telephone lines and work them for the benefit of the State.

CABLE TELEGRAPHY.

IN a paper recently read before the Franklin Institute, America, Mr. Patrick Delany gives a description of an apparatus which he has devised for the purpose of increasing the speed of working on long ocean cables. The general arrangement is shown by the fig., and the working of the same is as follows:—

A (fig. 1) represents a receiver at the distant station. An ordinary polarised relay is shown, but it might be a mirror instrument, or a Thomson recorder, or any other receiver. One side of the relay is connected to earth. To the other side is connected the line, L, or cable. This line is connected to the revolving trailer, T, of the polarised transmitter, P, S. The trailer is carried by the spindle of star wheel, C, revolved by the pallet end of the armature of P, S. C, *d* is a condenser connected to the plate which projects between the segments in the circle. There are two sets of segments, *e* and *f*, in the circle besides the plate segments. Set *f* is connected to insulated contact, f', under the front of the key. Segments, *e*, are connected to the insulated contact, e', at the other end of the key. Contacts f^2 and e^2 are connected respectively to the positive and negative poles of a main transmitting battery, M, B, which is grounded in the middle. The key is connected to the polarised transmitter, P, S, thence to the middle of local battery, S, B, the ends of which are connected to the contacts, *c* and c', under the back and front ends of the key. As everything now stands, the cable is entirely disconnected. The operation is as follows: If the key, K, be pressed down the positive pole of battery, M, B, is connected to the cable through contacts f^2 and f' and segment *f*, upon which the trailer is resting. When the key reaches contact c', which is its limiting stop, the local circuit of magnet, P, S, is closed and the armature thrown to the right, which moves the trailer off of segment *f* and breaks the connection between the cable and the main battery. The trailing finger is slanting, so that it bridges segment *f* and the intermediate or plate segment connected to the condenser while it is passing from segment *f* to the next segment, above which is one of the *e* set, and in doing so connects the positive pole of the main battery, M, B, to the condenser, thereby charging it. When the trailer leaves segment *f* and touches only the condenser segment, the charge which the condenser received, while the trailer bridged the two segments is sent into the cable and meets and neutralises the static discharge created by the impulse which went into the cable when the key was closed and the trailer was on segment *f*. The trailer does not stop on the condenser segment, but passes over in one movement of the armature of P, S to the next segment group, which is connected to the contact, e', at the back of the key.

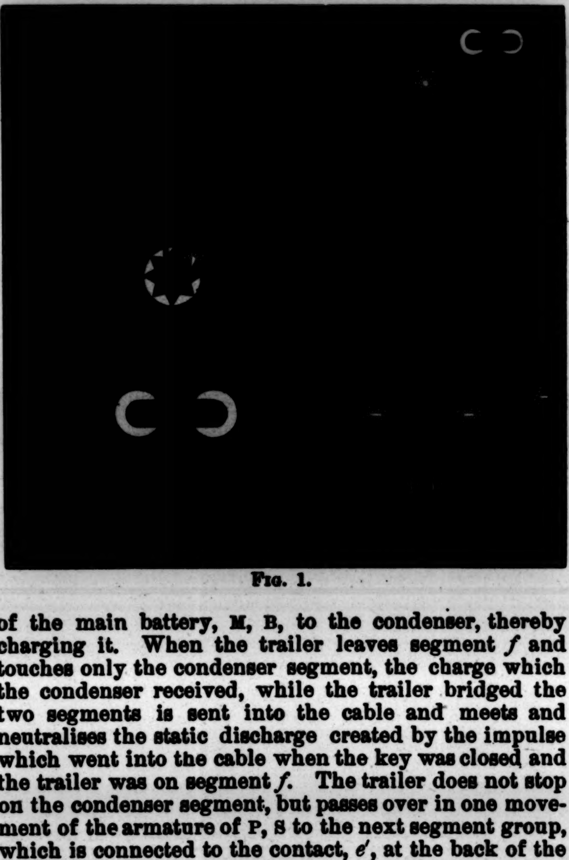
FIG. 1.

Now, if the key be raised the negative pole of the main battery, M, B, is connected to the cable through contacts e^2, e', segment *e*, and the trailer. Immediately that the key reaches its limit, contact *c*, the local battery, S, B, is reversed through P, S, and the armature moved to the left again, which terminates the contact of the negative pole of the battery with the cable, charges the condenser and discharges it into the cable as before, thus neutralising the static discharge coming out of the cable from the negative impulse sent in. In this way, signalling impulses of alternative polarity are sent into the cable and discharge impulses from the condenser neutralises the static charge in the cable. The force of the condenser discharge may be adjusted to the capacity of the cable by the use of resistance in the condenser circuit. It will be observed that the duration of the contact of the cable with the main battery is determined by the time f', f^2, or e', e^2, come together in advance of the local contacts, c', c^2, which reverse the circuit of the transmitter, P, S, plus the time required for the trailer to pass off of the segment. This time may be lengthened or shortened, within limits, by adjusting the key contacts. The inventor states, however, that he has a plan for lengthening the duration of contacts, which affords a much wider range, and by which the impulses may be adapted to any length of cable.

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* Details of the State purchase of telephones may be seen on another page.—EDS. ELEC. REV.

Mr. Delany states in his paper, "I am convinced that if each signalling current is immediately followed by a neutralising current of electromotive force, adjusted to the static discharge, the speed of signalling may not only be greatly increased, but the received marks will be unmistakable." The author is evidently unaware that all this ground has been gone over before, and that what he suggests is very ancient history; he might with advantage study (amongst others) an article which appeared in our issue of February 1st, 1877, on "Thomson and Jenkin's Automatic Curb-Sender," or Mr. Ewing's description of the same which was published in 1876. Quoting from the latter, we have the following:—"It will be seen that a current gradually diminishing in strength continues to flow out of the cable at the distant end for a considerable time after the battery has been disconnected. This continued discharge is what gives rise to the difficulty experienced in reading the signals sent through long cables. The principle of 'curb' sending is to check this discharge by sending into the cable a second current which will neutralise the bad effects of the first." It is further stated: "The gain in speed due to the use of the automatic curb sender appears to be at least 50 per cent."

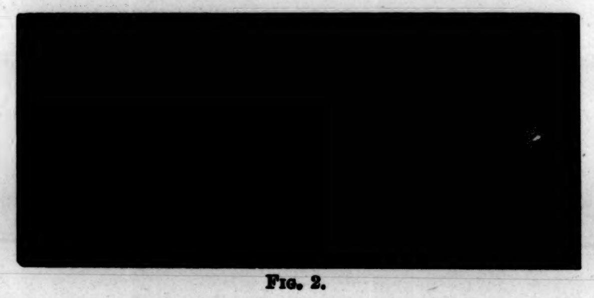

FIG. 2.

More than 20 years ago Sir William Thomson devised a clockwork "curb" key, of which we give an illustration (fig. 2), the object being to send a series of reversals, each differing from the previous one in duration, into the cable, and thus to quickly wipe out the original charge. The advantages possessed by this key were, however, not found in practice to be sufficiently great to render the same of material value, and we are inclined to think that Mr. Delany's (so-called) new invention in actual practice also will not be found to give the results which he anticipates. The ultimate method of obtaining quick working will be, we imagine (as we have more than once stated), one in which by some automatic devices the charge in the cable will be wiped out by reversals sent in at *both* ends of the cable; that is to say, the transmitting key will send in a reversal, and the movement of the receiver at the distant end will also send in a reversal. Mr. Delany's statement in his paper, "My own opinion is, that the great need in cable telegraphy is bad insulation, or a *good bad* insulating material; something that will not go from bad to worse under the action of the current," is one which we have over and over again insisted on.

IRONMONGERS AS DEALERS IN ELECTRICAL APPARATUS.

CONSIDERING the great development now taking place in electric lighting, it is not to be wondered at that some of our trade contemporaries should be waking up to the fact that if they do not devote attention to the subject, they will before long be left in the lurch. The *Ironmonger* is probably the latest which has taken up the matter. On the 13th inst., in an editorial on electric lighting, after giving particulars of the forms of Provisional Orders prepared by the Board of Trade, that journal states that "electrical meters, transformers, batteries, cut-offs (*sic*), wires, lamps and fittings generally ought to be 'studied up' and understood by every ironmonger. . . . . . This electrical business will probably be a big one before long, and it ought to fall into the hands of ironmongers. It is thoroughly pertinent to the ironmongery business, and every effort should be made to prevent it from drifting into other channels." We must confess that this is a very bold statement to make. We have not the slightest objection to ironmongers becoming acquainted with electrical matters; but how the electrical business could possibly fall into their hands, or in what way it is pertinent to ironmongery, we are at a loss to understand. Does the *Ironmonger* imagine when the Provisional Orders now *sub judice* are granted, and when many establishments have the electric light, that the latter will, on the breakage of a meter, transformer, battery, wire, lamp or fitting, proceed to the first ironmonger's shop for a substitute? If this is the conclusion arrived at by our contemporary, which, in its articles, referred chiefly to London lighting, it is a very wrong one. Light and power in the metropolis will, sooner or later, in almost every case be supplied for obvious reasons from a central station. The company owning the station will lay the cable, fit up the installations, furnish meters, transformers, batteries (where desired), and, in fact, everything required, and will sell current either by meter at so much per unit, or at so much per lamp. The company will also attend to the renewals, for which a certain charge will be made. Therefore the only part of the electric lighting business in which an ironmonger could possibly participate is in the supply of a few glow lamps occasionally at a higher price than that charged by the company who supplies the current, and whose station is too far distant for the customer to go for a few lamps at once.

In another leading article on the same subject in its last issue, after making a few remarks to manufacturers of electric light apparatus and fittings, and after paying a tribute to that gentleman whom a monthly contemporary recently so ably entitled our "only electrician," the *Ironmonger* winds up by saying:—"Now that the light is about to be offered on reasonable and commercial terms, the great majority of the better-class houses of the metropolis, as well as the offices and shops, will use it. Before they can do so, however, wires, fittings, and lamps will be needed, and will have to be forthcoming in tremendous quantities. The lamps, of course, will be procured from the few patentees, and the wires will doubtless be available when they are wanted. But what about the fittings? the brackets, the arms, the standards, the iron, copper, brass, bronze, glass, &c., electroliers, the hall lanterns, and so forth—where are they? Who is making them in new and attractive patterns, and who is prepared to supply them? These are the questions which are being asked on all sides in the metropolis, and the answers forthcoming are few in number, and not always satisfactory. Consumers tell ironmongers that they do not want old-fashioned things; they want something novel and effective. Those in the West End of London are not very particular as to price. Give them something at once novel and artistic, and they will be content."

The answer we have already given to our contemporary's first article is also a reply to its second editorial, with the exception of the question regarding the fittings. Now, if the *Ironmonger* will only take the trouble to look through our advertisement pages, it will there find out who is prepared to supply, and who is at present making, all kinds of brackets, arms, standards, electroliers, hall lanterns, &c. The question will then be satisfactorily answered.

Alternate Current Working.—Mr. Mordey has kindly forwarded to us a copy of his reply to the criticisms levelled at his paper on "Alternate Current Working," which was read before the Institution of Electrical Engineers on May 23rd. We regret that we must hold this over until our next issue.

STATE PURCHASE OF THE TELEPHONE IN FRANCE.

THIS subject led to a long and acrimonious debate, lasting two days, in the French Chamber of Deputies. The order of the day called for a project authorising the Government to treat with towns for the establishment of telephone lines of local interest, and to borrow the necessary sums to effect the purchase of the lines worked by the General Telephone Company. M. de la Batie opposed this project on two grounds: In the first place, the State and the General Telephone Company were now at law on the subject of the purchase by the State of the line worked. Parliament could only intervene by showing its contempt for regular jurisdiction, in meddling once more in an affair of common right, and in putting its hand on private property. In the second place, the public interest was opposed to the working of the telephone by the State. Telephonic science had not said its last word; it would be necessary for the State to support the charge for incessant renewal of apparatus, or else the public would be served with worn-out apparatus. The speaker asked that at least the vote should be adjourned till the result of the trial was known. It was time, moreover, that the State gave up dabbling in financial adventures, and this latest one would cost, to start with, 10 millions.

A Government commissary having defended the project, and a number of other speakers having been heard, the debate was adjourned till the following day.

On the resumption of the proceedings on the second day, M. **CAMILLE DREYFUS** spoke as follows: Gentlemen,—In commencing the examination of Article 1 I must make a declaration: it is that I do not intend to enter in any way into the very interesting debate begun yesterday. There may have been trials and there may not; it matters little to me. I consider that the Government, in asking us to purchase the telephone lines, has used a Crown right, and that it only belongs to us to seek under what conditions and in what circumstances it makes this proposition to us. I will keep on the same ground as M. Georges Cochery, Reporter of the Special Committee. The Government asks us to buy the interurban lines, and it proposes to us at the same time a financial system which is contained in Articles 2 and 3, which leads me to tell you that, though I really speak on Article 1, I shall be induced to examine Articles 2 and 3. What is the system proposed to us? A new constitution is proposed, which you will allow me to define in one word; it is a syndicate between the State and the municipalities. On what conditions is this syndicate constituted? Is it made under conditions which safeguard the State finances and those of the municipalities? That is what I ask your permission to examine in a few words. The Government Commissary, at the end of his speech, set forth an assimilation between the telephone lines and the telegraph lines. He told us: Would you admit for a single moment that the telegraph lines should be installed by private companies, in the hands of private people? Well, let him permit me to tell him that there is no absolute assimilation to be established between the telephone and telegraph. I ask permission to give you very briefly the reasons of the distinction. When you go the telegraph office and present your little blue paper, a despatch which you wish to be sent somewhere in Paris, the provinces, or abroad, from the moment you have paid the fee your relations cease with the administration. The latter then takes the responsibility. Is it the same with the working of the telephone? Does not one find himself in constant communication with the telephone administration? Allow me to speak as a man who has largely used the telephone. If we already had the marvellous instrument promised us by Edison, which allows one to speak hundreds of leagues, and to see the people with whom one speaks at the same time, it is probable that I should abstain from certain vivacities of language before the young persons employed at the telephones if I had been able to see them as well as hear them. That, however, is not a great inconvenience, as far as regards private companies. It would be disagreeable, however, to be prosecuted for the use of "lively" language to an *employé* of the Director of Posts and Telegraphs. [M. Charles Floquet: You will have the benefit of the Assize Court.] The Assize Court has no fears for me. My dear colleague should know that, as he has defended me several times before it. When you establish a telegraph wire, it is for the use of all; as well for the workman who wishes to send a message to his wife, as for the banker or merchant who wishes to make a speculation. Is it the same with the telephone? Will it not, despite developments, remain the privilege of the few? I repeat that comparison is not possible between the telegraph and telephone. The telephone is an instrument of luxury, while the telegraph has passed into the common life. [Some lively interchanges here took place, one member accusing M. Dreyfus of being a partisan of the purchase on the previous day.] I am still a partisan for the purchase. The objections which I make now I made in 1884 to the Paris Municipal Council. After these few observations, I will leave the tribune in proposing an additional article to paragraph 1 of Article 1, and an additional article to the project of law. I am certain if I do not succeed to-day, to-morrow will find me right.

The **PRESIDENT**: I put Article 1 to the vote. "Article 1.—The Government is authorised to accept, in the name of the State, the offers which shall be made to it by towns, public establishments, or syndicates, of depositing with the Treasury, as an advance without interest, the sums necessary for the establishment, maintenance, and working of urban telephone wires, and to devote the products of each line thus created to the reimbursement of the advances which shall have been made upon it without other engagement on the part of the State. There will be rendered an account each year to Parliament of the treaties passed in execution of this disposition and of the position of each of the lines thus established." Before putting this article to the vote, I will read the addition proposed by M. Dreyfus. "Towns or public establishments shall only be able to make offers of sums, of which there shall be assured as a preliminary the deposit by those interested." After some further discussion, paragraph 1 of Article 1 was adopted. On the addition of M. Dreyfus being put to the vote, it was rejected. The whole of Article 1 was then adopted.

The **PRESIDENT**: Article 2.—The Government is authorised to devote to the purchase, to place in good working order, and to the development of the telephone lines of the General Telephone Company an advance up to 10 millions to be made to the Treasury. The reimbursement of this advance will take place in 10 annuities at the most, calculated at a rate of interest of 4 per cent."

COMTE DE KERGARIOU inquired whether the Government undertook not to exceed that sum. In the course of his speech he said: Gentlemen,—I can understand the wish to vote this law quickly, but I am astonished the committee does not give some explanations. If you are *au courant* with the details of the project under discussion, if you recognise that the project of 1886, which is now modified, was as detestable for State as for private interests, everyone does not appear to be in accord on this subject. What is of interest to me is to know whether the credit is limited, or whether it may rise to a higher sum. It would be useful to know the Budget Committee's opinion on the subject. It seems that a sum of eight or ten millions is not worthy of your examination. For us it is a considerable sum. It is indispensable to know whether this sum is to be exceeded or not, or if, on the contrary, the committee has good reasons to say that it will not.

The **REPORTER** of the Committee: It will meet all three expenses: purchase, putting the lines in good repair, and the immediate development of these lines.

After some further wrangling, article 2 was adopted. To article 3—"The advances to the Treasury will be inscribed on the budget of receipts for 1889—1890," under paragraph 7 (exceptional resources).

M. GOIRAND proposed the following additional paragraph: "The dispositions which precede shall be no obstacle to the creation and working, by communes, of telephone lines serving their districts. These creations and workings will be regulated by a decree in the form of a regulation of public administration."

M. Goirand and the Reporter of the Committee having spoken, Article 3 was put and adopted. Articles 4 and 5 were also adopted, and then **M. MERILLON** spoke on the whole project as follows: Before voting the whole of this law, I wish to put a question to the Director-General of Posts. I wish to know whether that gentleman intends to take steps so that the telephone staff shall not be victims of the suppression of the company's service.

M. COULON, Government Commissary: The desire of the Government is to add to the staff of the Posts, if not the whole of the staff, at least the lesser staff of the telephone company. Our intention is to subject the servants whom we retain to a probationary period before employing them under the State. It is the intention of the Government to lower the tariffs; but the Chamber will understand that in this connection the Government must reserve its entire liberty of action.

M. FAURE: It could make known its intentions.

M. COULON: The Government cannot fix and make known at present the precise limits in which this lowering of tariffs will be realised. The question to be solved touches upon an order of very complex considerations; it must be made the object of a preliminary examination; it must be subjected to profound study. In these conditions, the Government must limit itself to affirm—and it does so in the most formal manner—that it enters absolutely into its intentions to benefit the public by a notable reduction.

M. DE KERGARIOU: What proves that the calculations of the Government repose on nothing determined is that it cannot enter into any decided engagement now.

The **PRESIDENT**: I now put to the vote the whole of the project.

A demand was made for a scrutiny, and the President announced the result as follows:—Number of voters, 500; absolute majority, 251; for the adoption, 435; against, 65.

THE ELECTRIC LIGHT IN BERLIN AND AT ELBERFELD.

From "Le Bulletin de la Société Belge des Electriciens."

(*Concluded from page* 63.)

AT ELBERFELD.

On arriving at Elberfeld, the railway makes a slight curve round the town, and it is thus seen as in a hollow. Seen thus at night, the town resembles one of those great factories, like that of Krupp, at Essen, for which electric lighting has become, as in Belgium, the general rule. The white electric light globes appear numerous, hidden in turn by the buildings, themselves set off by their white windows. A characteristic glimmer illumines the air, charged with steam, and forms like a dome of clearness above the agglomeration. What gives Elberfeld this peculiar appearance at night is the quantity of arc lamps used in the streets for lighting shop fronts. These lamps are placed outside, like reflected gasburners which are used now, specially by jewellers. There is a notable economy for shops to replace this row of gasburners by these electric lamps placed outside. This private lighting contributes largely to the lighting of the public streets, and the promenaders, by the irresistible attraction of this light, direct their way to the points thus abundantly lighted. There is, again, in the streets of Elberfeld, the most complete variety of all kinds of lighting. By the side of a shop lighted with magnificent petroleum lamps, one finds a hairdresser's shop, or a cigar shop, lighted by incandescent lamps; there, gas with the old shaded burners, or Wenham and Butzke lamps; elsewhere, arc lamps outside or in. There are few applications of electricity to public lighting. The Elberfeld station is communal; it was constructed for the city by the firm of Siemens & Halske. This firm had to work the station two years before handing it over; the guarantee for the cables was fixed at five years. The station is built nearly in the centre of the town, 200 metrès from the river, in the Hofkampferstrasse. It will be remarked here, as at Berlin, that the choice of a position for the stations (for direct currents) is regulated especially by the preoccupation of a situation favourable to the distribution of the current, considerations relative to the carriage of the necessary coal and water being considered second. The following are details of this station:—It has a superficies of 400 square metres for the machinery room, and of 484 for the generators. It has been fitted to supply 10,000 16-candle lamps; it will allow of 14 dynamos of 43,000 watts each, or 602,000 watts altogether. These dynamos will be worked by seven steam engines, of Kuhn's (of Stuttgardt) system, with Knüttel regulation, of 170 horse-power effective, fed by five Cornish boilers with 123 square metrès of heating surface. The line is calculated for 10,300 lamps of 60 watts, of 100 to 120 volts. The system in use is that known as the three-wire; the dynamos work two in series. The greatest length of the cable is 800 mètres on one side, and 970 mètres the other side of the station. This system shows the advantage of a great saving in cables over the two-wire system of Berlin, and, consequently, permits of transport to greater distances. The largest cable (triple) employed at Elberfeld has a section of 3 × 330 square mètres. The three cables are concentric and enclosed in a single armed covering. Let us remark that this system is to be employed at the new stations being constructed at Berlin, and also at Mülhausen. The commutation table in the Elberfeld station is very interesting.

The working of this station was begun on November 15th, 1887, with 2,500 lamps installed. The present number of subscribers is about 100, with 4,300 lamps installed, or their equivalent (nearly 2,300 incandescent lamps and 250 arc lamps). Four engines and eight dynamos are at work, of which a fourth is in reserve. The average use of the lamps installed has been 1·75 hour per day from November, 1887, to November, 1888. In winter the average use is three hours. Satisfaction is expressed at Elberfeld with Aron meters. The number of meters of 12½ ampères (the smallest) is 50 per cent.; those of 25 ampères form 30 per cent. of the total of subscribers. The conditions of subscription at Elberfeld differ little from those of Berlin. The price of the ampère hour is the same. The prices of placing the meters are lower. The annual tax of 6 marks per lamp installed is not maintained; but each lamp must burn an average throughout the year of 1½ hour per day. If, according to the indication of the meter, it is found that the lamps have not been used this minimum number of hours, a charge is made of 2 pfennigs for each hour wanting. The official results published are very favourable; it will be understood, however, that conclusions, at the end of the first year of working, would be premature. In order that these conclusions should be of value, it is necessary that the working should be more advanced and in its normal course. The results from April, 1888, to April, 1889, will soon be known and published. The confidence in the working on a large scale of the electric light is so great in Germany that several municipalities have not hesitated to follow the example of Elberfeld. Installations at Hamburg, Lübeck, Bremen, Frankfort and Magdeburg are being carried out. It is to be remarked that in Germany few applications have hitherto been made of the system of distribution by transformers. Some accumulators are employed at Vienna; they will also be utilised at Darmstadt and Barmen. The imposing Ferranti installations at Deptford, where engines of 10,000 horse-power will be at work at the end of the year, and at Kensington, will show us much as to the use of high-tension currents. It will be particularly interesting to see how the cables will behave under a 10,000 volt potential. According to the declarations of M. Ferranti before the Board of Trade, the trial made with a potential of 1,000,000 volts on a certain length of cable was very satisfactory.

The reason why low tension has been generally adopted in the installations hitherto made is the small extent of the line. In most cases, the distribution of electricity has been limited to a single central part of the town in which direct supply, without transformation, was possible without leading to an exaggerated expense for canalisation. The three-wire system allows of the distribution within a radius of a kilomètre. When more considerable extensions are entered upon high tension currents will probably be utilised. Then the experience of this kind of distribution will be more complete; and, without doubt, also, alternate current electro-motors will be found and experimented on. But there is a desire not to wait; electricity becomes a general need. The light "de luxe," as the gasfitters call it, in regard to its present price, will in a few years have taken a formidable extension. There is no longer a town, however unimportant, which does not seek the means of installing it. The luxury, moreover, is a very relative matter. Nearly every novelty begins by being an object of luxury, a superfluity for which the need does not exist. This law is verified in small things as in great. When the first Swedish matches arrived in the country, it seemed that they would never succeed in making us abandon those which had till then perfectly satisfied us; to-day they are in every household. When the first tramways were laid down, they were only looked upon as a modification applicable with utility to the long line of omnibuses; at present the towns are crowded with trams, and the receipts are as high for the big lines as for the small. It will be exactly the same with the electric light. Its price, which is higher than that of gas, to-day restricts its use to special cases where its advantages are evident—theatres, public establishments, shops, and workshops. But we are convinced that the greater number of those who now pay for the luxury of lighting by gas will only wait to take to electricity till its price be lower or equal to that of gas. Despite all the improvements in intensive burners the preponderating place of gas in the domain of lighting will be invaded by electricity as soon as it is suitably worked on a large scale. Further, the electrical industry every day makes marked progress, and the reduction in price is only a question of time. Gas is perfectly suitable for uses in which it is a question of producing warmth. But, in producing light, a gas burner only utilises a very small portion of the energy consumed; the remainder is lost in heat. The electric lamp, on the contrary, transforms into light a very notable fraction of this energy. That is what has been already often repeated, and lately again by M. Aimé Witz, in his lecture to the Industrial Society of the North of France. "Let us compare," he said, "the yield in light of a kilogramme of coal in the two cases. This kilogramme supplies the labour of a horse-hour, and it can consequently feed at least seven 16 candle lamps, producing more than 15 carcels; the same quantity of pit-coal, distilled in a retort, will produce 80 litres of gas, from which will be drawn at most 3·2 carcels. Nothing can prevail against these figures, despite the utilisation of the sub-products of gas factories." In the same lecture we find the following calculation:—"Sixteen candles give 2·2 carcels; a London argand burner, with double crown in steatite, burns 90 litres per carcel; that makes 198 litres per 16-candle hour. This light costs in electricity 6 c. 5; that is, consequently, gas at 33 c. the cubic mètre. We conclude that in towns where gas is cheaper than 33 c., electric lighting by incandescence is a luxury."

Since I am speaking, allow me, gentlemen, to examine this conclusion. M. Witz was right in seeking to place himself on practical ground, and, for the same reason, we believe we are doing a useful thing in showing that M. Witz did not go far enough, and that, consequently, he was led into error in his conclusion. We have just now at our disposal a very instructive official document, giving particulars of the survey made for the reception of the electric installation at the Monnaie Theatre. The average luminous value of an electric lamp in service is less than its initial intensity. It is, therefore, in the first place incorrect to calculate as M. Witz does, the intensity of a lamp said to be 16 candle by multiplying by 16 the value of a candle. This value of the English candle is not, moreover, that given it by M. Witz, that is to say, 0·135 c.; this is rather the value of the German candle. The English candle is weaker. In the second place, the denominations of lamps of 16, 20, &c., candles are purely commercial; incandescent lamps always exceed, and notably, their nominal value (contrary to what happens in general for arc lamps). In short, there is only one means of getting true figures—direct experiment. It has been given us by the survey at the Monnaie, where experts took at hazard 50 lamps among those in service and having been very variable periods in use. If we take among these the 16-candle lamps, we find the experts tried 25, and that their average luminous intensity was 2·22 carcels. By accident, M. Witz's figures correspond with the result of this experiment. On the other hand, the true luminous value of gas burners has been measured. For iron butterfly burners there were found (by eight experiments) 221 litres of gas per carcel hour; for butterfly burners in steatite (12 experiments) 195 litres per carcel hour. Only the results furnished by the iron butterfly burners need be noted; in a theatre the keeping up of these burners leaves much to be desired. But with regard to other burners of this theatre, where a gasfitter is permanently employed, we must admit that their maintenance is not different to that of similar trade burners employed everywhere. In the second place, we observe that in private houses and shops, gas is burnt half by butterfly burners and half by others. In cafés and workshops it is rather the butterfly burners which are in a large majority. Let us admit, in the meantime, that the carcel of light, obtained by consumers in their lighting by gas of the present service, is furnished by the average of consumption of the two kinds of burners. It would result then, from the details given above, that in the present service the carcel of light demands $\frac{195 + 113}{2}$, or 154 litres of gas per hour. M. Witz accepts as the mean price of sale of electricity 6 c. 5 per hour lamp of 16 candles. This average results from the prices of the few following small stations:—Bellegarde (8 c.), Perpignan (6 c.), Nancy (6 c.), Elberfeld (5 c.), Bremen (6 c.), Milan (4 c.), adding thereto 0 c. 5 for renewal of lamps. It is strange that the Berlin price does not figure in this list. It is, however, from installations of this nature that we must rather take the price of electricity, and not from small installations like Bellegarde, Perpignan, Bremen, &c., which do not number 3,000 lamps. At Berlin the price is 5 c., or 5 c. 5 with the lamp, and this price is still further reduced, as we have seen above, as soon as the duration of lighting attains 800 hours. At the Berlin price, which, according to us, can alone be considered as applying to stations of any importance, the carcel hours costs, therefore, $\frac{5·5}{2·2}$, or 2·5 centimes. From what precedes, we conclude that the carcel hour furnished by gas lighting by the apparatus at present in use being 154 litres, the same light, furnished at the Berlin price at 2 c. 5 by the incandescent lamps of the present service, costs as much as if one burnt gas at $\frac{2·5}{0·154}$, or 16·2 centimes the cubic mètre.

As will be seen, we are very far from the figure of 33 c. given by M. Witz, and according to which he is led to say that the electric light is a light of luxury. In order to make a serious comparison, we must absolutely consider the *final* result at which we arrive in the two kinds of lighting. Our deductions are supported on such results; we will add that the electric and photometric experiments of the Monnaie installations have been specially executed and directed by the same experimenter, Prof. Rousseau, whose competence no one will contest.* These are figures taken in reality, and have nothing in comparison with those on which M. Witz has argued. The London argand burner notably, with double crown in steatite, which was taken as a type by the lecturer, is a burner which the public does not employ, and *will not employ*. A very important remark to make on this subject: whatever the efforts made by the gas industry for so many years past, the public accepts no other burners then the quite simple trade burners which it will neither repair nor renew often. It is principally, remark it well, in order not to have this tiresomeness, that the public prefers gas to petroleum, and willingly pays more dearly; the other motives are but secondary. The infatuation for intense lamps, Wenham and others, will perhaps only last a certain time; at the end of a few years only it will be seen that a long use will have decided. "The sale price of central stations being equivalent to gas at 33 centimes, we will conclude," says M. Witz, "that in towns where gas is cheaper, incandescent lighting is a luxury." But precisely in all the large towns, where gas is cheaper, the sale price of electricity will also be lower than the average thus calculated according to the price of small towns. The price of electricity, like that of gas, varies with the importance of the town considered with the importance of the working. You see the inconsequence of such a general rule. In a preceding paper, we estimated at 120 litres per carcel hour the average consumption of the gas burners in use. The verifications obtained by the experts at the Monnaie Theatre show how moderate this estimate was; and now we will keep to our figure of 120 litres. In adopting this figure, incandescent electric lighting would be gas at $\frac{2\cdot5}{0\cdot120}$, or 20 c. 8. Let us say, at the maximum, 22 c., in order to take into account, so as to forget nothing, how much dearer the electric meter is than the gas meter, at present, at least. Such is for us the estimate of the *actual* price of electric lighting by incandescence compared to gas lighting.

The work of M. Witz, which has been reproduced *con amore* by the gas journals, also contains other errors which will come to the notice of all electricians. Thus 1 horse-power feeds now, not 7 16-candle lamps, but from 8 to 10, the minimum being 8. Thus, it is not permissible to compare the industrial yield of a kilogramme of engine coal with that of a kilogramme of gas coal without mentioning the difference in price. The gas coal costs at the pit mouth 50 per cent. more than the best engine coal; at the place where it is used there is still a difference of 30 per cent. We will conclude by a few reflections on the subject of what M. Witz, and the public in general, call an element of undeniable inferiority of central stations over gas works. That is, that electricity has not yet reservoirs comparable to gasometers; that, consequently, the energy must be produced in proportion to the needs, and that it is necessary to have a large reserve material. One must guard himself from exaggerating the inconvenience of this necessity for electricity. The situation is not at all the same for the two products: if such a necessity existed for gas, and it were necessary to make gas in proportion to and during the time of consumption, the difficulty would be enormous, one may say, impossible. Storage is a facility for gas, but also an absolute necessity; the expense of gasometers is a forced one, like that of reserve machines for electricity. In a central station, comprising a series of motors, the expense for the reserve is not proportionally so large as that for gasometers at the gas works. These gasometers are important structures, which, without reckoning the ground, absorb 30 per cent. of the capital necessary for the whole works. One must also not imagine that in a gas works there is no apparatus installed to guard against possible accidents. There is always specially a considerable gasometric reserve; there are extractors in duplicate, ovens, canalisations, &c. Accidents are possible in gas distribution as in that of electricity; but the latter having hitherto only been worked in small installations, in which the expenses to be incurred in order to obtain complete security are regarded as too large, there have often been extinctions. In an important central station, perfectly installed in all respects, the guarantees which the reserve machines present are greater than those resulting from the presence of gasometers in gas works. We have seen the whole lighting of a town interrupted after an explosion in the gas mains; on another occasion, after an escape of gas, a fire has rendered the apparatus in the regulator room unserviceable, &c. Obstructions in pipes and explosions are causes of the danger of extinction much more to be feared in gasworks and much graver in their consequences than are the possible accidents in a good central electrical installation. Marine engines, and those used in the working of mines, are striking examples of the almost absolute safety realised now in mechanical installations. By varied means electricians succeed in considerably decreasing the inconveniences referred to. They instal machines which can increase their power within considerable limits; the working then becomes less economical, but it will be understood that in that there is a calculation of compensation to establish. This disposition is much in use in America. Also, there are employed, in some installations, accumulators, the object of which is to supply a part of the current during the critical hours of the evening. The two means can be employed at the same time. We are well aware that the accumulators now known are not yet very practical or economical. But it would not be astonishing to see produced, before many years, in a few months perhaps, a good accumulator. Numberless researches are directed to this object in every country; and we may be certain that they will not cease till it has been found. For our part, we know of several new systems now being experimented upon very seriously, patents for which will not be taken out until they are put in working by strong companies.

But we have no need to discount the future. Present facts and results suffice. They confirm the conclusions to which we have come previously, in which we have insisted on the true value of the luminous apparatus *in use*. "Taking into account," we said, "these different practical considerations, one must conclude that if electric lighting can be delivered at 5 or 6 centimes per hour lamp of 16 candles, and at 3 or 4 centimes per hour lamp of 10 candles, the difference between the cost of the two lights becomes less, and may even be *nil*. The prices in different towns show that we are not far from this position." Our gasfitting friends will not fail to recognise the justice of the observations which long practice in the distribution of gas permits us to make. They can but know us as willing to seek to set forth the true position, and, notably, to remove the errors committed even by the best-informed persons, when they do not look at the question from the general data of reality. They will convince themselves that the opposition, formerly justified, is no longer so, at least in large towns, and that it is perhaps to their interest to follow the example already given by several gasworks, which have themselves resolutely undertaken the supply of electricity. We maintain that as soon as a central electricity station can be established in our towns, with prices as above, the favour of the public, now gas consumers, will be promptly acquired. We do not wish to say immediately and at one stroke; but at the end of the shortest time compatible with the habitual inertia which every innovation must vanquish. The objection drawn from a certain difference in price compared with gas is not so important as is believed. The public does not calculate like us, basing their deductions on photometric results; it only becomes disquieted within large limits. It sees scarcely any difference between a light of 1½ carcel or of 2 carcels. The unit of light is not for it

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[*] This report is being printed. It is made by MM. Rosseau, Van Vloten, and Vinçotte, and is a remarkable work. It contains a quantity of interesting information; the methods of measurement employed are set forth in detail, with numerous and very intelligible schemes.

the carcel, but the lamp or burner. Practically, there are two units or types: the lamp for the office or dining room, and that for the corridor or underground. The *number* of luminous *foyers* influences the total expense much more than the variation of supply or individual expense between the varieties of luminous *foyers*. Thus, the public only considers two things: (1.) Comfort. (2.) The total cost of the lighting of its premises. It is always the first consideration which carries it when the second does not show too notable a difference. Proof of this is superabundantly supplied by gas customers themselves; in order to enjoy the comfort which gas brings, they spend double what it would cost them for lighting with handsome petroleum lamps. Let not any one oppose us here by laboratory experiments; we say that in practice gas lighting costs double that of petroleum, even at the present low price of gas. For these consumers there only really remains one of the above considerations—comfort. In place of paying double to have gas, they will pay quite as much, and even more, to have electricity, if it offer them any advantage whatever in the way of comfort. We have shown what are the numerous cases in which this advantage exists. When, then, electric lighting is established on a large scale in a sufficiently important centre, we may rest assured that it will be adopted by a large majority of gas consumers. We are convinced as regards Brussels, the price of electricity there being possible to be lower even than that of Berlin, where the coal used for the engines costs 24 francs per ton!

NOTES ON THE DYNAMOS AT THE PARIS EXHIBITION.

II.

THE dynamos of M. Fabius Henrion, of Nancy, which we illustrate in figs. 1 and 2, are well worthy of notice. These machines are of the Schuckert type, with disc armatures, being, indeed, a development of the well-known Schuckert machine, which at one time was made by M. Henrion. The smaller incandescence lighting machines and those for arc lamps in series are made with two poles, as in fig. 1, while the larger sizes for incandescence lighting have four poles, as in fig. 2, or a greater number depending upon the currents to be carried. The armature core is formed by winding soft iron wire on a gunmetal supporting ring, which is turned slightly hollow on the rim for its reception. To this gunmetal ring are fastened the arms which carry the armature round, these projecting outwards from the ring on each side of the core, to afford lateral support for its several layers of wire. Between the adjacent layers strips of paraffined paper are interposed, these practically dividing the iron of the armature into a number of concentric ribbons, by the edges of which the lines of force enter. After being properly insulated with coverings of tape the core is Gramme wound in the usual way. It will be noticed that in the two-pole machine, fig. 1, the magnets, instead of being placed one directly above the other, lie at an angle of about 45 degrees, this arrangement rendering the brushes and commutator very accessible. When constructed for arc lighting these machines give generally a current of 8 ampères, to suit the normal type of Pilsen lamp, and are built for any difference of potentials up to 1,000 volts. Machines of this pressure support 20 lamps in series taking 50 volts each. They have in their commutators 56 sections.

The two methods of regulation which are employed by M. Henrion for keeping the current constant under a varying number of lamps are very neat. In an installation of incandescence lamps the difference of potentials at the mains has to be kept constant, while the current varies to suit the lamp requirements, but in an installation of arc lamps in series the current has to be kept constant, while the difference of potentials varies with the number of lamps alight. Until recently there were no dynamos supposed to be capable of constant current regulation save the Brush and Thomson-Houston machines, since from the way in which the connections were made between the armature coils and commutators these were little influenced in their working by sparking, which in Gramme connected machines would have proved fatal. But lately there has been introduced quite a host of constant current regulators applied to ordinary Gramme wound machines, the working of which has proved very successful. These are generally in the nature of a mechanical device for varying the angle of the brushes on the commutator, the action of which is governed electrically, and thus becomes automatic. One of M. Henrion's methods consists in the application to his machines of such an arrangement, the second method he employs consisting in varying the resistance of a shunt across his field coils.

The automatic regulator used for the latter is shown in fig. 3. It consists of two tablets, on the upper of which is fixed a solenoid, A, with a movable iron core suspended by a spring, and on the lower two electromagnets, B and C, the resistance coils, R, and the mechanical gearing below. A, B, and C are in direct circuit with the arc lamps, the current under normal conditions going through all three in series. The spring by which the core of A is suspended can be adjusted for any strength of current within limits. The extremities of the core are provided with contacts so arranged that its movement in one direction has the effect of short-circuiting the coil of the magnet, B, while its movement in the opposite direction short-circuits the coil of C. Some distance below B and C is fixed on the tablet a stud upon which two ratchet wheels, fastened together but with their teeth cut in opposite directions, are free to move. To these wheels is fixed a radial arm, the outer end of which makes contact with the studs of the resistance coils and by its movement increases or diminishes the resistance, R, shunting the fields. Pivotted on the stud carrying the wheels is an oscillating lever, the lower end of which is slotted while the upper end has fixed in it a pin which carries a double ended pawl capable of engaging the teeth of either ratchet wheel. This pawl in its normal condition lies horizontally and has its ends directly under the electromagnets, B and C. When these latter are equally magnetised the pawl does not engage either ratchet; but if one of the magnet coils is short circuited, the end of the pawl under it immediately falls on one of the ratchet wheels, and being carried backwards and forwards by the oscillating lever, the wheels, and with them them the radial arm, are moved round, thus increasing or diminishing the resistance as necessary. The oscillating movement is given to the lever by a pin lying in its slotted end, this pin being screwed into the face of a disc at the end of a short spindle driven from the dynamo or countershaft. When the current is at its normal value and flowing through A, B and C in series, the iron core of A occupies an intermediate position in which no contact is made with B or C. But when from an increase or reduction of the current the core of A ascends or descends, B or C is at once short-circuited, and the pawl dropping on one side the radial arm is moved until the current again attains its normal value.

For his method of altering the angle of the brushes on the commutator, M. Henrion employs a modification of the gearing above shown. The regulating solenoid, A, and the magnets, B and C, are carried on a standard fixed on the dynamo frame, and to the ratchet wheels is directly attached the quadrant carrying the brushes. Here no resistance coils are necessary. It will be seen that as the pawl engages one or other of the ratchet wheels the lead of the brushes is increased or diminished. At the Exhibition there is a machine for 15 lamps, in which the automatic regulator is attached directly to the brush quadrant. We were unfortunately unable to see this machine at work, but M. Henrion assures us that he can by this arrangement vary the lamps from 1 to 15 without causing sparking at the brushes.

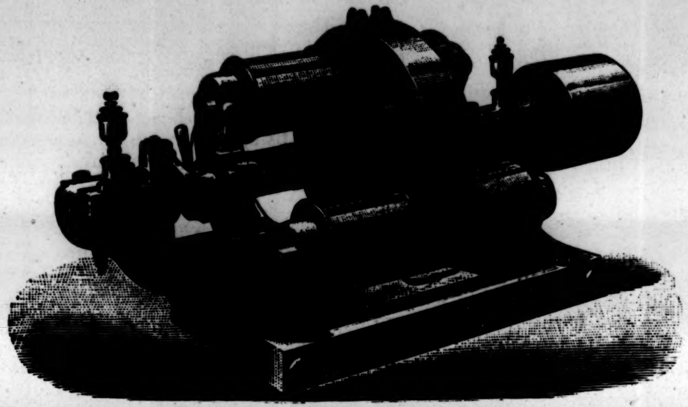


FIG. 1.

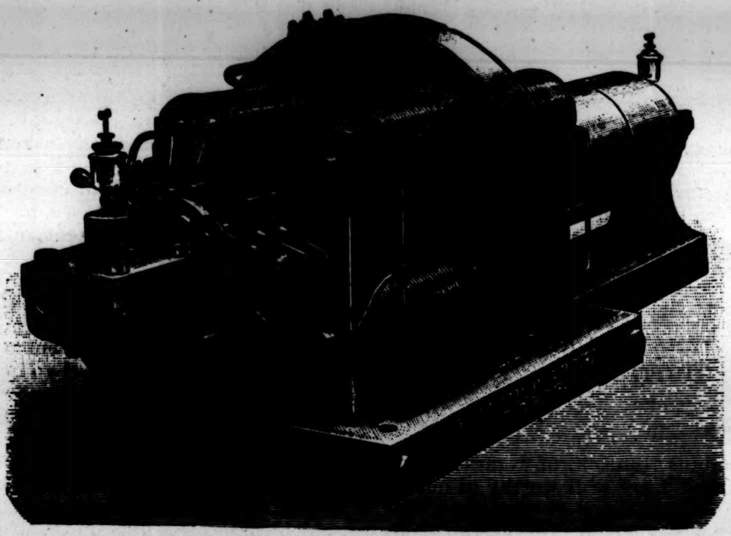


FIG. 2.

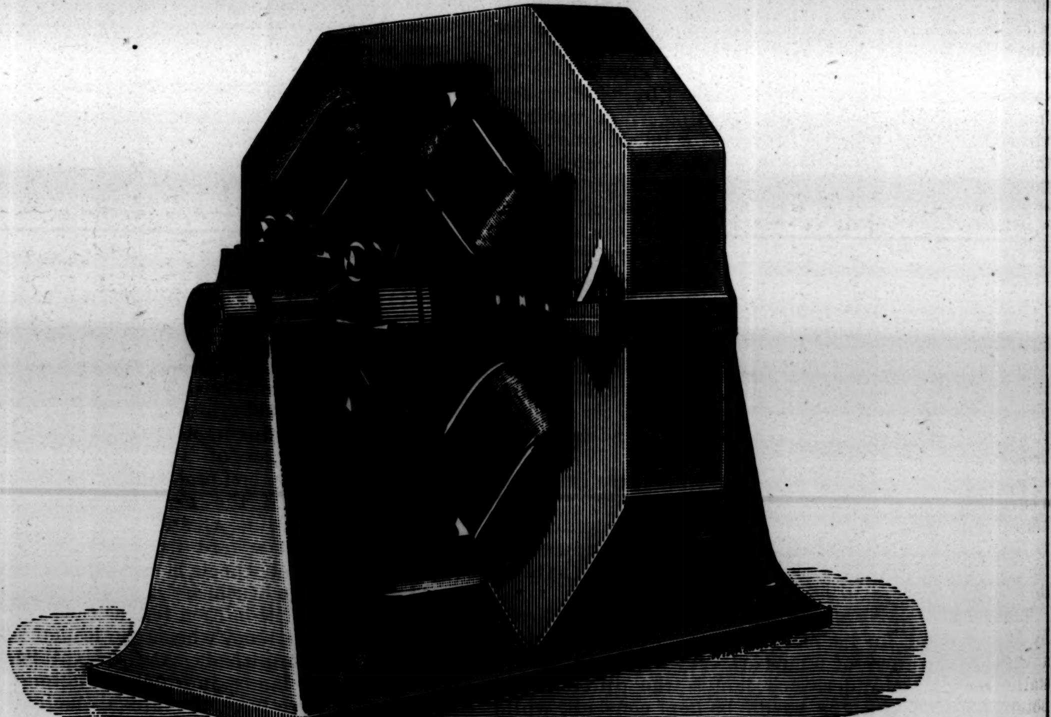


FIG. 4.

As will be seen from fig. 2, the current from the 4-pole machines is collected by two sets of brushes at 90°, the coils being cross connected by a series of brass rings placed side by side, which are insulated from each other and from the shaft, and form each a connection for diametrically opposite coils. For incandescence lighting these machines are generally compounded to 110 volts, two poles being used for currents from 10 to 112 ampères, and four poles from 150 to 350 ampères. For a current of 550 ampères 6-pole machines are employed, while a machine for 1,000 ampères would have eight poles and make 170 revolutions per minute.

From Nancy, in France, to Zurich, in Switzerland, is a fairly long journey by rail, but the Paris Exhibition annihilates distance by bringing very close together the products of these remote localities. Leaving the exhibit of M. Henrion it takes from two to three minutes to arrive at the display of the Oerlikon Maschinenfabrik, our exact rate of progress depending on the number of visitors present, which depends again on the hour at which we make our inspection. At the Oerlikon show our attention is at once attracted by a large 4-pole dynamo for the transmission of power. A diagrammatic representation of the field of this machine is given in fig. 5, the perspective view, fig. 4, giving a general idea of its appearance. The generator at the Exhibition has, however, three bearings, instead of two as shown, a bearing outside the driving pulley being omitted in our engraving. At 480 revolutions the machine transmits about 240 electrical horse-power at a difference of potentials of 600 volts. The field is of cast iron and made in two parts, the lower part with two of the radial magnets being cast with the bedplate, and the upper part with the remaining two magnets joined to it horizontally, as shown. The magnetic system may be defined as consisting of two single horseshoe magnets with split yokes, the latter being constituted by the heavy octagonal frame surrounding the magnet limbs. The armature is of the ring type, and is built up of soft iron washers ·024 inch thick, insulated with paper. A spider keyed on the shaft, and furnished with eight arms, which fit into notches cut in the interior of the core, carries the armature round, this spider being in two halves lengthways, and bolted together after the washers are in place. The armature is 22 inches long, and measures in diameter over the winding 37 inches, having a centre opening of 23 inches. It is wound Gramme fashion, in 200 sections of two convolutions each, the conductor consisting of a stranded cable of 19 copper wires of ·051 inch diameter, cotton braided on the exterior and varnished. Roughly, but as near as can be judged without actually applying our rule, the circumferential distance between adjacent magnets measured on the armature circumference, is equal to the circumferential width of the magnets. The latter would thus be about 15 inches, and this multiplied by 22 gives 330 square inches as the area of the magnet cores, the area of the octagonal yoke frame being rather over half this, or 170 square inches. The current is collected by four sets of two brushes, each brush being about 2 inches wide, and as opposite sets are connected in parallel, this gives four brushes for the collection of about 300 ampères. The magnets are series wound, each limb having 60 turns of copper sheet 12 inches wide by ·04 inch thick, the four limbs being joined in series. Power is transmitted from this to a similar machine in the Swiss section, which as a motor drives weaving, flour-milling, tile-making machinery, &c. In order that the speed of this latter may be the same as that of the generator, while allowing for the E.M.F. absorbed internally in the motor and leads, its armature is wound with a somewhat smaller number of convolutions than the generator. The switches employed for the line wire are similar in principle to those introduced by Siemens some years ago, where the arc formed on breaking is gradually lengthened between carbon points until before the circuit is absolutely broken the current is greatly diminished.

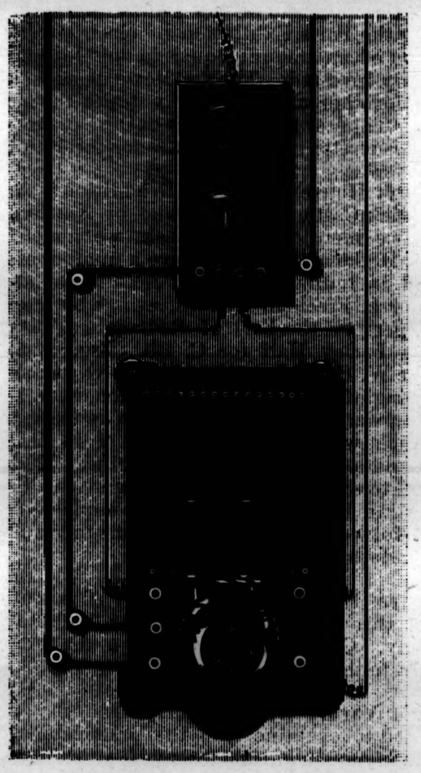


FIG. 3.

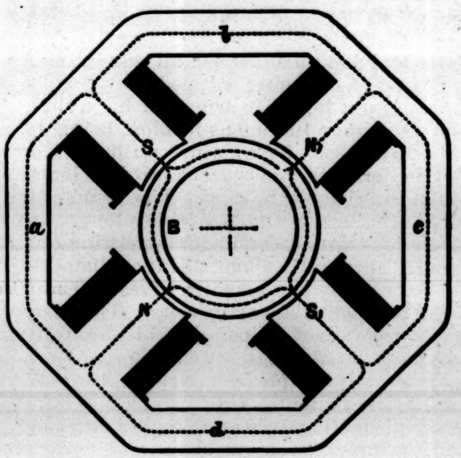


FIG. 5.

The Oerlikon two-pole machine, of normal type, is also exhibited. This presents no remarkable difference from the well-known Manchester machine, save that in its iron parts it appears to be somewhat more massively built. The particular machine exhibited is directly coupled to a 60 H.P. compound vertical engine running at 350 revolutions per minute. It gives a current of 500 ampères, and is shunt wound for a difference of potentials of 65 volts. The armature conductors are wound as ordinarily on the exterior of the core, and not inserted in holes pierced longitudinally near the periphery, as was the case when this machine was first introduced.

A four-pole machine, having a field like that proposed by Kapp some years ago, is also shown by the Oerlikon Maschinenfabrik. A sketch of this field is given in fig. 6, where it will be seen that the magnetisation is produced by two coils only. This type is employed for ship lighting as the external field is very small. For the reason that they are surrounded to a great extent by iron, these machines have been termed ironclad dynamos, but it must not be thought that because there is no external field there is no *stray* field. As a matter of fact the stray field in this type of machine may be set down as comparatively large, but the parts between which the leakage takes place are inside and hidden from observation. The advantage of the type for ship lighting lies in the fact that the stray field occupies a position in which it does affect appreciably the ship's compass, that is inside the machine. This dynamo is coupled to a 20 H.P. vertical engine running at 480 revolutions per minute. The standards which support the cylinder and also form the guides, the bedplate and field magnet are all cast in one piece, the magnetising coils being slipped in place before the armature is put in. The armature has a ring core, but the coils are wound Siemens fashion, being laid on the outside surface of the armature with their cross ends passed underneath pins which project longitudinally from the interior of the core. The armature is about 17 inches in diameter and 17 inches long. It is wound in 64 sections with a conductor consisting of two wires in parallel, apparently about ·134 inch diameter, braided on the exterior. The machine gives 200 ampères at a difference of potentials of 70 volts. The current is collected by two sets of copper plate brushes resting on the commutator 90 degrees apart, the armature sections being internally coupled in series. A goodly display of regulators, switches, fuses, and other accessories is shown by the Oerlikon people, but a description of these lies outside the scope of the present article.

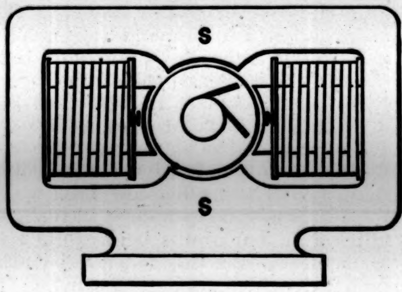


FIG. 6.

(*To be continued.*)

NOTES.

The Lighting Question at Maidstone.—The Maidstone Gas Company has refused to accede to the petition of the local authorities to reduce the price of their gas for public lighting, and consequently the Local Board have appointed a committee to consider the proposals of the Municipal Electric Light and Power Corporation, the Electric Construction and Maintenance Company, and the South of England House-to-House Electricity Company, who have given notice of intended application to the Board of Trade for provisional orders sanctioning the supply of electricity in Maidstone under the Electric Lighting Acts of 1882 and 1888. Some time ago a company was formed for the lighting of Maidstone by electricity, but the Local Board obtained an order for the deposit of £500 before any of the roads were broken up, and nothing more was heard of the project. It remains to be seen whether the committee will recommend the compelling of the companies now applying to deposit this sum.

Mill Lighting by Electricity at Morley.—Mr. A. W. Bennett, of Leeds, is busy putting an installation of the electric light to the Prospect and the Daisy Hill Mills, for 210 lights in the former, and 70 in the latter. Messrs. Mather and Platt have made the dynamo.

The Electric Lighting Bills and the County Council Petitions to the House of Lords.—At the London County Council meeting on Tuesday last, held at the Guildhall (Lord Rosebery presiding), a report of the Parliamentary Committee was brought up by its chairman (Mr. C. Harrison). The committee stated that the four Bills for the confirmation of ten provisional orders, issued by the Board of Trade, with respect to electric lighting, together with one private Bill, the Metropolitan Electric Supply Bill, against which the Council had petitioned, came before the Committee of the House of Commons on the previous Tuesday. The Council had been able to secure several necessary amendments, but the Select Committee had not, in the judgment of the Highways Committee and the Parliamentary Committee, conceded satisfactory provisions for the protection of the Council's bridges. The latter committee therefore recommended :—"That petitions be presented to the House of Lords with a view of obtaining satisfactory provision for the protection of the Council's bridges." The recommendation was agreed to by the Council without discussion.

Paris Exhibition Lighting Syndicate.—It is said that Messrs. Woodhouse and Rawson have just received, as one of the members of the syndicate who have been lighting the Paris Exhibition by electricity, a first distribution of an amount equal to double the sum they originally invested. The syndicate is expected to get back altogether a return of six times the amount invested. This result just bears out the prognostications of our leaderette in the REVIEW for the 12th inst.

Country House Lighting.—In addition to the lighting at Alnwick Castle for the Duke of Northumberland, which we mentioned last week, we understand that Messrs. Drake and Gorham have a number of contracts in hand, including a 300-light installation at Batsford Park, for B. Freeman Mitford, Esq., who succeeded to the property of the Earl of Redesdale. They are also lighting Farley Hall for C. Bill, Esq., and Oxenden Hall for W. H. Barfoot Saunt, and have just commenced the wiring of another large mansion near London, in which upwards of 300 lights are to be fixed, the power for which will be obtained from a 14 H.P. Cornish boiler, and a 12 H.P. Marshall engine. The above, in addition to some wiring contracts and the lighting of the African Bank, which is to be completed next week, have involved considerable additions to the firm's contracting department.

Theatre Lighting.—The Exeter Theatre is to be lighted throughout by the Exeter Electric Lighting Company. Gas will, however, be available in case of accident to the plant.

Jack's Yarn.—We are sorry that the committee appointed to examine into the practicability of electrically connecting lightships with the shore, should have recommended that the scheme be abandoned on the score of expense. It was fully demonstrated that such communication could be maintained in any weather and that it would be of great service to lifeboats in going out to wrecks, yet human life is rated at such a low value that the committee considers the cost of connecting up is not warranted. This is surely a matter upon which public opinion should be generally aroused. Poor Jack will still have to mainly depend upon that "sweet little cherub who sits up aloft."

Electric Tramways in Australia.—The Sandhurst and Eaglehawk Electric Tramway Company, Limited, formed for the purpose of putting down a tramway and working it electrically, have entrusted the work to Messrs. Booth, Ellson and Company, electrical engineers, of Melbourne, who have placed the order for the plant for the charging station with the Anglo-American Brush Electric Light Corporation, Limited, who will also supply the cars, motors and accumulators. It is expected that the first section of the work—a line five miles in length—will very shortly be in operation.

Electrical Storage Cells.—The Berlin correspondent of *Industries* states that a new type of storage cell, patented by Herr Correns, is being introduced by a company, which has lately been started with a considerable capital, under the title of the Berliner Accumulatoren Werke. The distinguishing feature of the Correns plates is the formation of the grid, which consists, properly speaking, of two grids with square holes, the two being so laid upon each other that the corners of the squares in one grid come opposite the centres of the holes in the other grid. In this manner the filling paste, instead of being in the form of so many separate plugs, forms one continuous mass over the surface of the plate, whilst still preserving a sufficient surface of contact with the bars of the grid. To prevent falling out the grids are rolled after casting, so as to slightly burr over the edges of the ribs. The question of producing accumulators of large output and light weight is generally engaging the attention of electricians in Germany, several of whom are at the present time experimenting in this direction.

Government Standardising Laboratory.—The Board of Trade desires to avail itself of the organisation of the London Chamber of Commerce for the purpose of ascertaining the probable extent to which a Government laboratory for standardising electrical instruments would be used. (*a*) By supply companies, for the certification of meters, voltmeters and ammeters; and (*b*) by manufacturers of electrical instruments. Replies to the accompanying questions, to be returned to the London Chamber of Commerce, are therefore requested. Individual replies will be considered as confidential, and only the aggregates will be published.

	During	
	1890.	1891.
1.—Supposing a standardising laboratory to be ready at the commencement of the year 1890, how many ordinary house meters do you expect to send in for certification?		
2.—How many ammeters do you expect to send in?		
3.—How many voltmeters do you expect to send in?		
4.—State whether you send in as an undertaker or as a manufacturer?		

Name...

Address..

Date...

Mr. A. P. Trotter writes to us as below:—"The following has been sent to certain manufacturers and agents, with the view of avoiding duplicate returns relating to the same instruments. The suggestion should have been embodied in the circular."

"London Chamber of Commerce. Government Standardising Laboratory.—Please take precautions, in sending your replies to the circular issued to-day, against possible repetitions of the same instruments by manufacturer and agent, or supplier, *e.g.*, yourself and————.

"A. P. TROTTER, *Correspondent*."

New Submarine Cable.—The Chilian Government invites tenders for the supply and laying down of a cable between the two ports of Mellipulli and Sandy Point, and the intermediate stations on the Pacific coast, being a length of about 1,000 miles. The conditions and plans may be consulted in the offices of the Chilian Legation, 5, New Burlington Street, W., from 2 to 4 p.m. Circulars containing necessary information may be obtained on application.

The Lightning Rod Man Again.—An American contemporary notices the expiry of a patent for "improvement in lightning rods," and describes it "A lightning rod made of an interior and an exterior copper shell, and provided with a zinc centre or core." The rod itself, it will be seen, contains the elements of self-destruction without any external assistance from lightning.

Harold P. Brown and his Critics.—A gentleman in New York, of the name of Gutman, in making adverse comments upon the experiments of Harold P. Brown on the relative danger from continuous and alternating currents, thinks that the safest of all electrical systems must be an alternating current supplying the light through transformers; and he also imagines that the higher the potential in the main circuit is raised the safer will the system become. The correctness of this statement he considers proved by the fact that no person has been killed in Europe at a station using alternating current machinery. The chief reasons why fatalities have occurred in America are, according to Mr. Gutman (who has, we believe, a transformer of his own design), due to the bad workmanship of the material and the unqualified and untrained kind of labour obtained, as well as to the circumstance that every person is at liberty to string wires according to his own sweet will. Mr. Gutman has a modicum of pity for the medical authorities who were convinced by Brown's experiments; but this, perhaps, would have been better reserved for himself.

Electric Companies' Balance Sheets.—The *Citizen* of the 20th inst. severely criticises the balance sheet of the Electrical Power Storage Company. Readers of the REVIEW with a taste for analysing accounts, will find some very interesting items in our City contemporary, combined with some pregnant comments which shareholders in companies generally may take to heart with advantage to themselves for future use.

Fairplay is a Jewel.—We mentioned a fortnight since that a writer in *Fairplay* was attempting to teach his readers the principle of dynamo-electric machinery in a series of papers entitled "The Electric Light on Ships." His latest contribution is upon arc lamps, and we now read that "carbons are, like copper wire itself, very good *conductors* of electricity." The next article is intended to deal with incandescent lamps, and here the writer will doubtless find himself in his true element.

Testimonial to Prof. Kennedy.—In consequence of the announcement by Prof. Kennedy that he will resign the Chair of Mechanical Engineering at University College, London, W.C., at the end of the present session, his past and present students, in appreciation of his valuable services as head of the engineering department of the College, desire to present him with some token of regard, in expression of their deep sense of admiration for the zealous and courteous manner in which he has so ably filled the Chair, held by him during the last 15 years. As the committee is unable to obtain the addresses of many past students, we have much pleasure in giving publicity to a proposal which we feel sure will meet with general acceptance. The hon. treasurer is Mr. R. H. Willis, 17, Bear Alley, Farringdon Street, London, E.C., and the hon. secretaries, Messrs. W. Bashall, 17, Bear Alley, Farringdon Street, London, E.C., A. Fraser, the Engineering Society, University College, Gower Street, London, W.C.

Gummersbach.—Messrs. Müller and Einbeck, who exploit the Tudor accumulator, are erecting a central station in the town of Gummersbach, in the Cologne district, which has 8,000 inhabitants.

Meteorological Congress.—At this congress, which is to be held at Paris from 19th to 25th September, several papers will be read on magnetism and atmospheric electricity.

Telephony in Austria.—At the general meeting of the Vienna Telephone Company, a dividend of eight per cent. was declared.

Electricity for Gas-men.—At the annual meeting of the German Union of Gas and Water Experts, held at Stettin, a paper was read by Herr O. von Miller on "The Supply of Electricity to Entire Towns." Straws show which way the wind blows.

This Year's Electrical Companies.—The *Investors' Guardian* has published particulars of the new companies registered during the past six months, and we note that the share capital in electrical companies, which include telephony, amounts to no less than £3,833,600.

Standard Types of Apparatus.—The sub-committee appointed by the General Committee of the Electrical Section of the London Chamber of Commerce to consider the recommendation of standard or uniform types, desire to obtain information as to the extent to which the British Association screw thread has been adopted by the electrical trade up to the present. In the report of the British Association for 1885 (Aberdeen), it is stated that the standard screws "have been officially adopted by the Telegraph Department of the Post Office, and this step alone may be relied upon to ensure their general adoption by the telegraphic and electric instrument trades in the course of a few years." In the 1887 (Manchester) report, the following statement was made by Mr. Preece: "When the Post Office commenced to manufacture its own apparatus, it was decided to make all parts to template, so as to be interchangeable, and it was also decided to adopt some standard for screws. The standard recommended by the committee appointed by the British Association is now being introduced in all instruments and apparatus manufactured by and for the Post Office Department, a circular to that effect having been issued to all firms manufacturing for the G.P.O." Notwithstanding the above, a considerable number of manufacturers of electrical instruments are still quite unacquainted with these screws, and the committee feeling that the practical value of such a standard depends largely, if not entirely, on the extent to which it is adopted, invite communications from the trade upon the subject, and for that purpose have drawn up a set of questions, to which answers are requested. The result of the analysis of the answers to these questions will be communicated to the members of the London Chamber of Commerce, in order that those who do not use the screws may see whether their use is sufficiently general to induce their adoption.

Safety Device for Alternating Currents.—Messrs. Drake and Gorham inform us that they have made a long series of experiments with this apparatus, the patents for which they purchased from Major Cardew, and have found it reliable under all conditions. A number have been supplied to the London Electric Supply Company, for use on their supply station.

An improved Open Circuit Battery.—Mr. G. H. Bays, of Wakefield, is manufacturing a form of battery cell for electric bell and like purposes, which possesses several advantages over the ordinary form of Leclanché. The zinc rod is immersed in a solution of sal-ammoniac in a central porous pot, which is surrounded by crushed carbon contained in an outer jar, a carbon plate being placed in the broken fragments; the surface of the latter is sealed over with a layer of the usual asphalt compound. This disposition of the various parts makes the form of cells a very clean one, and, according to Mr. Bays, there is absolutely no creeping; the resistance of the cells (which measure 7 inches high and 4½ inches across) we have found by actual tests not to exceed ½ an ohm, a result which is decidedly good.

Electrical Distribution.—Under this title a pamphlet has been issued by the United Electrical Engineering Company intended to afford concise particulars concerning the system of distribution by means of alternate current transformers, describing its essential points, and supporting these by detailed prices of the plant and accessories necessary. Interesting details are given of the requisite plant, of which illustrations are added, and the figures intended to prove that supply stations pay a handsome profit, though somewhat fanciful, would no doubt, if accepted with caution, be found useful to any one contemplating an investment in such an undertaking.

Mutual Electric Manufacturing Company.—This American company has sent us a very handsomely got up book describing the Knowles system of electric lighting and traction by storage batteries. Mr. Knowles claims to have discovered a new inoxidisable alloy which is superior to all others, that support plates of this alloy do not buckle, that scaling, falling out of plugs of active material, and sulphating are all avoided, and that the battery has a minimum of inactive material in its construction with the maximum output of current, as compared with any other battery of its size in the market.

Military Telephones.—The military instruments of Messrs. Mix and Genest, which we show on another page, have been submitted to our inspection by that firm's courteous representative, M. Le Chevalier de Kleist, who is now staying at De Keyser's Hotel, Blackfriars Bridge. They are very practical, articulate, easily manipulated and, we imagine, eminently suited for their purpose.

Woodhouse and Rawson United, Limited.—This is the title of the new company, launched since our last issue, to take over the business of Woodhouse and Rawson, Limited, the Woodhouse and Rawson Electric Supply Company, Limited, the Woodhouse and Rawson Electric Manufacturing Company, Limited, the Woodhouse and Rawson Electric Contract and Maintenance Company, Limited, and of Chas. L. Baker & Co., Limited. All of these companies are in a more or less dividend-paying position except one — namely, the Woodhouse and Rawson Electric Manufacturing Company, on which a loss has been hitherto made, and in the case of the Contract and Maintenance Company also the balance is only just brought on to the right side—*i.e.*, that of profit. The capital paid up and considered paid up (the latter for stock and plant transferred by Messrs. Woodhouse, Rawson, and C. L. Baker & Co. respectively), together with £47,000 for the freehold premises, aggregate approximately to £287,000; but, deducting for the losses made by the one company indicated above, the total figures out at £269,000, the amount to be paid by the new company in cash and shares for the various businesses. It would, we think, have been better had more details of capitals paid up and of the position of each of the various companies appeared in the prospectus, as from the figures placed at our disposal we consider the prospects much more favourable than at first sight seemed possible. The actual value of stock, plant, &c., has, we understand, been by no means over-estimated, the reverse, indeed, being the case. It is to be hoped that the transformations of the Woodhouse and Rawson business are now nearly, if not quite, terminated, and that the United Company will continue to work energetically and reap a just reward. With Mr. F. L. Rawson's unbounded energy to obtain business, and with the extraordinary mechanical ability of Mr. C. L. Baker in the manufacturing department, we see no reason why this company should not achieve a first place in the list of similar concerns. It may be mentioned that on Monday, the first day of subscription, the applications were sufficient to allow of the company going to allotment, and that up to Wednesday night a very large proportion of the whole of the issues had been applied for.

Electric Lighting Bills.—The Liverpool Electric Lighting Provisional Order Bill has been allowed to proceed by the examiners of the House of Commons as an unopposed measure. The Birmingham electric lighting order has also been similarly dealt with. The Metropolitan Electric Supply Bill was read for the third time in the House of Commons on Wednesday.

Explosions in Accumulator Cars.—The letter which we publish from Mr. Fraser is somewhat curious, considering that next Tuesday is set apart for a Press view of the Barking Road-Canning Town line. Everybody present will want to see a repetition of the explosion, except the ordinary passengers, who could probably dispense with such extra inducements to patronise the cars.

Things Worth Knowing.—It may not be within the knowledge of every householder that he can supply his own or his neighbour's premises with the electric light without trenching upon the rights of electrical companies, so long as he does not break up or cross the public street. Gas and water companies have exclusive rights to supply their commodities, but electric lighting concerns are not able to prevent a householder from acting as above.

The Telegraphs Bill.—The operation of the Telegraph Act, 1878, has been extended to the Isle of Man after much negotiation with the island authorities.

Brewery Lighting at Tadcaster. — Amongst the numerous improvements recently carried out in this town, the electric light has been adopted by the Messrs Smith, of The Brewery. The work has been entrusted to Messrs. Holmes & Co., electricians, Newcastle-on-Tyne, and has been executed by them (through their agent, Mr. William Woodhead, of Leeds). The dynamo is a No. 12 "Castle" compound self-regulating machine, capable of supplying current for 230 lamps, of 16 candle-power each, at a speed of 800 revolutions per minute. The various parts of the brewery are lighted by Swan 16 candle-power incandescent lamps, suspended by flexible cords, and fitted with double contact holders and opal shades. The wiring throughout has been fitted up to the highest insurance rule, all wires being run in neat wood casing, both main and branch circuits being provided with safety cut-outs.

A New Sight-Feed Lubricator.—Messrs. Woodhouse and Rawson are manufacturing a new sight-feed lubricator (Fairbairn's patent), which is said to possess all the advantages of other sight-feed lubricators, without the disadvantage of the necessity of fixing to a steam pipe. It is perfectly independent, and is applicable to any bearing or other working surface, and the position of the rod above the cup clearly indicates to an attendant at a distance the amount of oil contained in the lubricator. The cover on the top of oil cup is removed and the piston drawn out; the cup is then filled with oil, and the piston and cover replaced. An adjustment screw allows any desired number of drops of oil per minute to float up through water contained in a glass tube at the side, from the top of which the oil flows down a small metal tube to the stem below.

The Telephone Amalgamation.—The new board is to consist of 15 directors, with a remuneration of £5,000, to which, however, a further amount will probably be added for the manager. The board of the United Company, consisting of nine members, was in the receipt of £10,500 (£1,500 for fees, £8,000 for percentage, and £1,000 extra emoluments of the managing director); the National directors' bill was £3,500 (nine directors), that of the Lancashire and Cheshire £1,500 to £2,000 (five directors)—total, say, £15,500 for nominally 23 directors; but several gentlemen having held seats simultaneously on several boards, the real number was 18. The new arrangement is, therefore, an improvement upon the former state of things.—*Truth.*

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Railway Automatic Electric Light Syndicate, Limited.—The statutory return of this company made up to the 8th inst. was filed on the 18th inst. The nominal capital is £10,000 in £25 shares. 367 shares have been taken. Upon 167 shares the sum of £5 has been called, the calls paid amounting to £830, and unpaid to £5. Upon 200 shares the sum of £5,000 is considered as paid. Registered office, 5, South Parade, Leeds.

Julien Electric Company, Limited.—At an extraordinary meeting of this company, held at 23, Queen Victoria Street, on the 3rd inst., it was resolved to wind up voluntarily, Mr. Joseph Smith being appointed liquidator. The resolution was confirmed on the 19th inst. and filed the same day. The company was registered 19th March, 1888, with a capital of £100,000 in £10 shares. The last return was filed on the 22nd August, 1888, and shows that 7,307 shares were issued, credited as fully paid up.

Western Brazilian Telegraph Company, Limited.—The annual return of this company made up to the 30th May, was filed on the 6th ult. The nominal capital is £1.500,000 divided into 73,014 shares of £15 each and 53,972 shares of £7 10s. each; of the former 64,572 are issued, and of the latter 53,972. The calls paid amount to £1,373,370. Upon 75 shares forfeited the sum of £565 has been paid. The total amount of shares for which share warrants comprising 5 shares each are outstanding, is £7,575, and comprising 1 share each, is £450. The total amount of share warrants, comprising 858 shares surrendered since the last summary, is £12,870.

Five agreements of 18th inst. state that in an agreement of 18th April, 1888, with the London Platino-Brazilian Telegraph Company, Limited, it was provided that the Western Company should issue by way of Exchange, 3 shares of the nominal value of £15 each for every 5 shares of £10 each in the Platino Company credited as fully paid up, to every member of the Platino Company who should within 14 days after the confirmation of the said agreement, or during such extended period as might be agreed upon, should apply for the same. The said period has expired, but the following holders of shares in the Platino are desirous of exchanging their shares for fully paid shares in the Western Company, and it is provided that the same be allotted as follows:—

Name.	Address.	Number of Platino shares exchange.	Number of Western Brazilian shares to be allotted.
M. Llambs ...	C/o Negretti and Zambra	30	18
E. Fyson	English Bank of the River Plate	50	30
Kenneth Anderson	10, Throgmorton Avenue	25	15
T. C. J. Bracht ...	Antwerp	20	12
M. Mesquita ...	Buenos Ayres	200	120

36 Western shares are also to be allotted to the partners of the firm of Sousa, Irmnos & Co.

South of England Telephone Company.—The annual return of this company made up to the 11th inst. was filed on the 16th inst. The nominal capital is £400,000, divided into 300,000 ordinary shares of £1 each, and 20,000 preference shares of £5 each, the whole of which are taken up. The whole of the ordinary shares are considered as fully paid, and £3 per share has been called upon the preference shares. The calls paid amount to £59,817 10s., and unpaid to £182 10s.

Woodhouse and Rawson, Limited.—The last return filed by this company is made up to the 11th January, and was filed on the 19th January, 1889. The nominal capital is £200,000, divided into 39,980 ordinary shares of £5 each, and 100 deferred shares of £1 each; 24,110 shares have been taken up, and upon 17,138 of these the sum of £1 15s. per share has been called, and £5 per share has been called upon 6,972 shares. The calls paid amount to £64,851 10s.; 110 shares have been forfeited, but no payment has been received in respect thereof.

Chas. L. Baker & Co., Limited.—This company was registered 3rd March, 1888, but up to the present time has not filed a return setting forth the amount of capital subscribed and paid up, together with a list of shareholders. The Companies' Acts require the holding of a meeting within four months of registration, and provide that the return should be filed within fourteen days after. Subsequent returns are required within fourteen days of the annual general meeting. A company failing to comply with these provisions is liable to a very heavy penalty.

Northern Press and Engineering Company, Limited.—The registered office of this company is at Barrington Street, South Shields.

Ruston, Proctor & Co., Limited.—The registered office of this company is at the Sheaf Iron Works, Lincoln.

LEGAL.

The Jensen Bell Electric Company—Action against the Promoters.—In the Patents Investment Company, Limited, *v.* Commercial Trust and Agency, Limited, which was tried last Thursday before Lord Justice FRY, in the Queen's Bench Division of the High Court of Justice, the plaintiffs sought to recover damages in respect of the non-fulfilment of an agreement to float the Jensen Electric Bell and Signal Company. The plaintiffs entered into an agreement with Mr. Lambert, as agent of the defendant company, to bring out a company to work certain patents known as the Jensen patents, and Lambert agreed to endeavour to bring out and float the company within one month from the signing of the agreement, and to bear all the preliminary expenses up to and including allotment. He also agreed to issue at least 100,000 prospectuses, to advertise in the usual papers, to engage the service of brokers, and to use his best and utmost endeavours to promote the proposed company, and to enable it to proceed to a successful allotment. The plaintiffs, who paid £1,000 to the defendants towards the expense of bringing out the company, contended that the defendants did not spend the money as provided under the agreement, that they did not find directors or brokers, and that they had not distributed prospectuses to a list of persons as provided. Instead of forming a proper company, the defendants had only started an abortive company. The plaintiffs therefore claimed damages for the non-performance of the contract, and the return of the £1,000.

Mr. Henn Collins, Q.C., and Mr. Black appeared for the plaintiffs; Mr. Finlay, Q.C., and Mr. S. Lynch for the defendants.

Lord Justice FRY, in giving judgment, said the plaintiffs alleged that the defendants had broken the agreement by putting out an improper prospectus, which contained only the names of three gentlemen as directors, all of whom were said to be directors of the plaintiff company. He would not express any opinion as to the propriety of putting on the list the directors of the vendor company; it might be a very objectionable proceeding, but it appeared that those gentlemen were selected by the plaintiff company. The plaintiffs could not recover for breach of contract, when they themselves directed that the prospectus should be in that form. His Lordship having dealt with the other points, said he came to the conclusion that there had not been want of good faith in endeavouring to float the company, and therefore there must be judgment for the defendants with costs.

CITY NOTES, REPORTS, MEETINGS, &c.

The Anglo-American Brush Electric Light Corporation, Limited.

AN extraordinary general meeting, to carry out the resolution of the report published in the REVIEW last week, was held at Cannon Street Hotel on Monday, the 22nd inst., Lord Thurlow in the chair.

The Secretary having read the notice convening the meeting,

The Chairman said: Gentlemen, I can only say it gives my colleagues and myself very great pleasure to come here to-day with the programme which you have all seen. It has been compiled with a great deal of care and deliberation, and I am bound to say it consults, in my opinion, your interests most closely, and I may say on behalf of every member of this board, that we consider that it cannot do otherwise than very greatly advance the value of the stock you hold; and on the other hand, if you do not pass these resolutions, and adopt the course we recommend, you will be standing in your own light. The report is very exhaustive, and I think gives you particulars of every point to such an extent, that I do not think it will be necessary for me to repeat what is in the report. It may be divided, roughly speaking, into five distinct points, all of them being of very great importance. The first deals with the question of litigation, which I am thankful to say is happily at an end. The second point deals with the reconstruction of the company, which it was not possible to proceed with until the important question of litigation, especially the Edison and Swan litigation, had been satisfactorily settled. The third point is the amalgamation with the Falcon Company. The fourth point is the proposed amalgamation with the Australasian Company, and the fifth point, that to which I will call your attention later on, and the future prospect of the company. As regards litigation, that comes under two heads. There is the Edison and Swan litigation, which has been a source of tremendous anxiety to us for the past two or three years, and not unnaturally so, and I believe of equal anxiety to the Edison and Swan people. That has been a matter of vital importance to the corporation. Then besides that, we have the similar action still pending, which is called the Compound Winding Case, and which is of so trivial importance, that I do not think it necessary to say more than a very few words with reference to it. In the case of the Edison and Swan, the settlement which we have arrived at, and which could not have been arrived at without a great deal of mutual compromise, is, I maintain, if not quite as favourable as any of you gentlemen might have yourselves dictated, is practically as favourable as it was in our power to secure. We had the alternative of proceeding to the bitter end. We had the alternative of going to the House of Lords, which we had expressed our intention of doing; that would have been a serious step, although I know that the majority of this board, and a very large proportion of the shareholders, were of opinion that if we had gone to the House of Peers we should have won our case; but there is always some uncertainty in legal proceedings, and there is the possibility that we might have lost, and if that had been the case, the position of this corporation would have been a desperate one; the damages would have been excessive, and we should have lost—and, I think, justly—the confidence of the shareholders, which we had hitherto possessed. In fact, I and several of my colleagues felt that had we pursued an obstinate policy and fought this matter out in the House of Lords, and the result gone against us, the doom of this corporation would practically have been sealed. We did not feel it wise to risk that, especially when, on the other hand, we had those gentlemen representing the Edison and Swan, who were, after all, reasonable men, also deprecating the final resort to the ultimate Court of Appeal. The result was that we agreed upon the terms you are aware of. Under these terms we give up manufacturing lamps, which up to this time, whatever it might have been in the future, has not been a very large source of profit; we are to get lamps from the Edison and Swan on the most favoured terms, and, moreover, they are to pay us a royalty. I think that having regard to the whole circumstances of the case, and to the very large issues involved, I think you will agree that we have acted wisely on this occasion in preferring half a loaf to the chance of no bread at all, and in making terms honourable to both parties. Then one word about the other litigation. The compound-wounding, which I have said just now is comparatively a trifling action, and stands in a very different position from the Edison and Swan action, in that they came to us for damages, we having from their point of view infringed their patents, of course we had a counter action, but that does not matter, they came to us, and if we had lost that action we should have had to pay most exemplary damages. In the compound case we hold that parties have infringed our patents, and the costs will be comparatively trifling compared to the gigantic expenditure of the Edison litigation, and as we are advised that we are in the right have therefore given notice of appeal against the decision in the Scotch courts. You are aware in the English courts the decision was in our favour and in the Scotch adverse; well, we have now the court of appeal. I should like to point out that the patent law relating to England and Scotland holds a very curious position, and I think I am not going too far in saying that before long the legislature will be bound to afford some remedy for the placing of the patent law on some satisfactory footing. It is owing chiefly to that that I attribute the loss we have sustained in the Scotch courts, to which in the meantime of course we must bow respectfully, although we have appealed against it. That is about all I have to say on the subject of litigation. We come now to, perhaps, a more interesting subject for us to-day, the reconstruction of the company. I know one or two shareholders questioned whether it was necessary to do that—I can answer that very simply. All companies have articles of association, and we have in our articles a clause which did not enable us, with perfect legality, to embark in engineering business. You also know that engineering now occupies almost the lion's share of electrical work. When the memorandum was drawn up that was not foreseen, and that being so it was absolutely necessary to enable us to compete to have a legal basis as an engineering company. At present we have to obtain from various foundries engines to drive our electrical machines; with these works which we propose to acquire we shall do away with the middleman, we shall get the profit of so doing, and I say again if we did not do so we could not compete on equal terms with the firms that are about to do so. I think that will be a satisfactory reason, indeed a compulsory reason for winding up this company and making a new one. There are other reasons and advantages which we could gain by winding up this company and forming a new one, for one thing we can divide our capital in a more satisfactory form, we can have preference shares and ordinary shares. And as you know it is proposed to give for each share held by you at the present moment one preference and one ordinary, that will enable us in all times to secure, at any rate, a good dividend on your preference share, and I hope, and not without considerable amount of reason, that you will have a handsome dividend on your ordinaries. There are other minor points which render it desirable in amalgamating with the Falcon and with the Australasian: it is much easier to effect terms with them starting fresh as a new company than if they were grafted on to our old company. I am glad to say I have received several letters praising our proposal that we have made—that is, calling up the £1 which is not paid on some of our shares. I think it is wise to adopt that course. I am owner of some of these shares, and I entirely agree with this course; these shares will be as saleable as the others at equal price, and I have no hesitation in prophesying that your shares will stand at a very handsome premium before long. That, perhaps, is sufficient at the present moment to say with reference to the amalgamation, although as I said at the outset I will answer with great pleasure, and as fully as I can, any question that may be asked. The Falcon Works have been visited by your directors; it is a paying concern. So far as we know, everything is in its favour; it has a reputation of having turned out good engines, and its machinery of being erected on approved principles. It contains a certain number of acres of freehold land remarkably well situated with reference to railways and canals, and will permit of indefinite extension. It is proposed to enlarge the works almost immediately, and plans are now being prepared for so doing. The enlargement will not be very expensive, costing comparatively a few thousands. As you all know, there is a question to which I have alluded to more than once, as to whether to increase our works in London or transfer them to the country. The Falcon Works solves this question by dividing the work. The electrical work will continue to be done in Belvedere Road, where the works have been erected with great care, and are eminently suitable for our requirements. These works are also valuable to us as a place to show foreigners and strangers who come with large orders to place, and which would not be easy to attract in the country. For that reason we retain the Belvedere Works, and a more beautiful set of works it is difficult to find. The Falcon Works at Loughborough will be our mainstay for heavy work and the manufacture of those engines which I have referred to. That being so, I will ask you to-day if you approve of the general programme that we lay before you to consider the projects of this work. It will not be in our power to pass a special resolution to that effect, on account of the technical clause which I have mentioned, which renders it impossible for this company to acquire the Falcon Works. What I want you to do to-day is to sanction their acquisition by the new company, and I shall hold that your general approval of this scheme conveys that sanction. We now come to the Australasian Company. That, again, is a scheme which we have had in our minds for some time. Australia is making rapid progress in electrical science; it is certainly far in advance of England and in advance of several Continental countries, and there will no doubt be a vast business in Australia. One reason why the Australasian Company came to us and enabled negotiations to be satisfactorily carried on was owing to the circumstance that a large number of shareholders of the one company were shareholders of the other company, and it is in their mutual interest to see the two companies working together. That circumstance, I feel sure, alone will enable us to arrange satisfactory terms with them. I hope there will be no hesitation on your part in seeking the contemplated agreement with the Australasian. I shall have to put it before you to-day, not entirely in final shape, for this reason, that there are one or two questions which are not quite settled; they are not sufficiently settled to justify us in asking you to accept the agreement in its present shape. We will therefore ask you to accept the agreement with or without modifications. As regards the future prospects of the company, I think they are practically secured. Electric lighting is in a very different position, and electric work generally, from what it was two or three years ago; the best proof of that is the readiness with which capital is now subscribed in England for these large undertakings, and it is only by amalgamation, and by bringing large companies into existence, such as this will be, with something like three-quarters of a million capital, that we can hold our own in the electrical world. As I said, for all practical purposes there is no alteration of your capital, the businesses we are acquiring are solid, one paying a dividend and the other about to. Another important point in electrical adventure at the present day is that electric companies have become wiser by experience. You no longer see enormous sums of money given for patents; there is no fear of your capital being absorbed in that direction. You may say electric companies have now sown their wild oats; it has become a recognised industry, like any other, in the City of London, and I know no reason, absolutely none, why it should not be equally remunerative. That is all I need say, except that if it does not pay a dividend in the first six months, I certainly shall not come before you again. I pledge myself to the fact that it will pay, and if it does not I shall disappear, because I shall consider I have led you astray; and I am grateful for the confidence that you have placed in me, as chairman of the company, during the last few years, without which we could not have surmounted the difficulties in which we have been placed. As regards the Board, it is not proposed to largely increase it; it is not a large one, as you know it was large formerly, but vacancies have not been filled as they have occurred, it is now a small one and not any too large for its present work. It will be necessary to increase it by two members, one representing the Falcon Works, that is agreed upon, and one representing the Australasian business, so beyond that, although there will be power in the articles to increase the Board, I do not propose that Board should be increased. I say that because I have received several letters from important shareholders, who have raised this point; but, as I said, it is not proposed that the Board should be extended beyond what I have already mentioned.

Mr. Lane-Fox said he wished to repudiate the right of the Edison and Swan people to manufacture lamps. He considered that the incandescent lamps were of vital importance to the progress of the electrical industry, and that the manufacture vested in the hands of any one company in this country would be a serious disadvantage to the future prospects of the industry. He thought it should be clearly understood that he, at any rate, did not consider himself bound to leave the manufacture solely in the hands of the Edison and Swan Company. He intended as soon as possible to start himself in the manufacture of them. In the recent case he tendered very material evidence to the Brush Company; they accepted proof, but did not call him, for what reason he did not know. He then offered his services to the Edison and Swan Company, but they also refused his offer; the facts were that he refused to accept a retainer, which in his opinion was an immoral practice often adopted by expert witnesses.

The Chairman said if Mr. Lane-Fox wished to start a lamp factory he was quite at liberty to do so; of course it would be at his own risk. If he could give him a word of advice, it would be to see the Edison and Swan people and see what he could get out of them, his experience was that, approached in a proper manner, they were very reasonable people.

The five printed resolutions which appeared in the report as to the reconstruction of the company were then put seriatim (the two resolutions relating to the Australasian Company having been modified) and carried unanimously.

A vote of thanks to the directors brought the meeting to a close.

The Exeter Electric Light Company.

THE first annual meeting of the Exeter Electric Light Company was held on Tuesday at the Exeter Athenæum, when there was a large attendance.

The Directors, in their report, stated that the demand for the electric light at Exeter had more than realised their expectations, about 1,000 incandescent lamps and a large number of arc lamps having already been applied for. The company had entered into contracts for lighting several public buildings and places of worship, and some of the citizens, including the proprietors of Half Moon and Royal Clarence Hotels, had decided to light their premises by the electric light. To meet these heavy demands, it was obvious that more capital would have to be acquired, and the directors were prepared to receive applications for 500 shares of £10 each, at par, being a portion of the company's unissued capital. Should the applications for shares exceed the number offered, the present shareholders would receive priority of allotment in proportion to the number of shares held. The Taunton Electric Light Company, Limited, which was formed on exactly the same basis as the Exeter Company, and which employed the same system, paid 5 per cent. the first year, 6 per cent. the second, and it was expected that, notwithstanding a large reserve and depreciation sum was to be carried forward, a 7 per cent. dividend at least would be declared. As it was confidently expected that as soon as the light was actually introduced the number of orders would greatly increase, the directors saw no reasons why the Exeter Company should not attain results quite as satisfactory as those of the Taunton Company. The capital already subscribed, including shares agreed to be taken, amounted to £7,000. Their balance sheet to 30th June, 1889, showed the capital account to be as follows: Dr. share capital subscribed, 466 shares of £10 each (exclusive of 234 shares agreed to be taken in part payment of plant which was being supplied, which would make the total capital subscribed 700 shares of £10 each, £7,000), £4,660. Cr. share capital unpaid, £2,061; amount paid for land, plant, machinery, and formation expenses, £2,069 4s. 2d.; cash in bank, £529 15s. 10d.; total, £4,660.

The Chairman, in moving the adoption of the report, said that they must all feel exceedingly glad that, after all the difficulties which they had surmounted, the company had been so well and successfully established. As to its ultimate financial success he was certain. The company's prospects were of the very best. Since they had published their encouraging report large orders had been received for lamps. The question now was one of capital, and he firmly believed that when a sufficient sum had been obtained they could get as many orders for lamps as they would be able to execute. It was desirable that shareholders should assist in obtaining more capital, and inducing their friends and the public to join the company. He believed the day was not far distant when every householder would be glad to get rid of the horrible nuisances attending the consumption of oil and gas, and gladly adopt the electric light. He did not believe that the electric light company would materially affect the dividends of the gas company, for he was sure that there was such a field for the use of gas as well as electricity that the more the electric light was used the more would be the demand for gas.

Mr. Massingham, in seconding the adoption of the report, observed that the price at which they were prepared to supply electricity to the citizens of Exeter compared favourably with that of other electric lighting companies. He perfectly agreed with the chairman that there was a wide field for both the electric and gas lights. Four years ago, when the electric light was introduced at Taunton, the gas shareholders were up in arms, thinking that they would be ruined, and that the electric light would entirely supersede gas. Instead of injuring the gas company it had created a demand for better gas lighting and more of it. The result was that the company had sold more gas, and one of the gas shareholders was also a director of the Electric Light Company. There was no more chance of the electric light doing away with gas than there was of steam doing away with horses. With regard to price, the Exeter Company would be able to supply electricity at a lower price than any city in the United Kingdom, with the exceptions of Taunton and Bath. He believed in London the prices averaged about 100 per cent. more than the price they (the Exeter Company) charged. Taking the provinces, Eastbourne, Brighton and Hastings averaged 200 per cent. more than they were charging at Exeter. The company appeared to him to have a very bright future before it. The work was progressing rapidly, and they hoped to be able, before the winter, to supply the light at a price which would commend itself to the general public.

The report was unanimously adopted, and the meeting closed with the usual votes of thanks.

The Direct United States Cable Company. Limited.

In the report for the six months ended June 30th, 1889, to be presented at the 24th ordinary general meeting of the company, to be held at Winchester House, 50, Old Broad Street, in the City of London, on Friday, the 26th day of July, 1889, at 2 p.m., the directors submit the usual statements of account for the half year ended June 30th, 1889, which, with the half year's accounts to December 31st last, presented at the ordinary general meeting on January 25th last, show the financial result of the 12th year's working of the company.

The half year's revenue (still subject to revision) including income tax refunded, and after deducting out-payments, amounted to £39,626 8s. 5d. against £17,507 17s. 2d. (after similar deductions) for the corresponding period of 1888, being a difference of £22,118 11s. 3d. in favour of the half year under review resulting from the current tariff.

The working and other expenses for the same period, including income tax, but exclusive of cost of repairs of cable, amounted to £16,676 3s. 9d., leaving a balance of £22,950 4s. 8d. as the net profit of the half year, making with £11,641 13s. 3d. brought forward from the previous half year a total of £34,591 17s. 11d. For the corresponding half year of 1888 the working expenses and other payments amounted to £15,276 11s. 10d.

Three quarterly interim dividends, of 2s. per share for the quarter ended September 30th last, and of 3s. 6d. each per share for the quarters ended December 31st and March 31st last, amounting to £27,319 10s. have been declared and paid during the financial year, and a final payment of 3s. 6d. per share is now proposed, making, with the three interim dividends, 3⅛ per cent. for the year, being a total distribution of £37,943 15s. The balance of £2,719 2s. 11d. on the revenue account is proposed to be carried forward.

The 1s. tariff continues, and the receipts have been largely increased, but a fairly remunerative revenue has not yet been attained. The traffic, however, is exhibiting signs of expansion.

An interruption of the main cable occurred on April 19th last, on the "Green Bank," and was repaired on May 19th. The cable was found to have been broken by a vessel's anchor. The cost of the repair, £4,474 1s. 11d., has been charged to the reserve fund account as usual. On the other hand the sum of £7,315 19s. 2d., being the interest and dividends received and profits realised on the sale of securities, has been added thereto. The directors do not on this occasion propose to further increase the reserve fund.

The appeal of the Cie Française du Télégraphe de Paris à New York referred to in the last report, was heard on the 12th, 14th and 19th March last, when the Council of the Prefecture of the Seine declared in effect that they had no right to enter into the joint purse agreements. An appeal to the Council of State is now pending.

Pursuant to the provisions of the articles of association, two of the directors, viz., Admiral of the Fleet, the Hon. Sir Henry Keppel, G.C.B., D.C.L., and Admiral R. C. Mayne, C.B., M.P., retire by rotation, and being eligible, offer themselves for re-election.

Mr. John G. Griffiths and Mr. John Sawyer, the auditors, retire pursuant to the articles of association, and offer themselves for re-election.

Anglo-American Telegraph Company, Limited.

In the report of the directors to be presented at the ordinary general half-yearly meeting of the proprietors, to be held in the Great Hall, Winchester House, 50, Old Broad Street, in the City of London, on Tuesday, July 30th, 1889, it is stated that the total receipts from the 1st January to 30th June, 1889, including the estimated balance of £1,325 13s. brought forward from the last account, are estimated at £144,992 7s. 6d. This amount, however, is subject to revision, dependent upon the result of the law-suit still pending between this company and the Paris and New York Telegraph Company. The traffic receipts show an increase, as compared with the corresponding period of last year, of £68,264, consequent upon the increase of tariff from 6d. to 1s. per word, which came into force on the 1st September, 1888.

The total expenses of the half-year, including repair of cables, &c., as shown by the revenue account, amount to £46,277 6s. 6d. One quarterly interim dividend of 12s. 6d. per cent. on the ordinary stock, and of 25s. per cent. on the preferred stock, was paid on the 1st May, 1889, absorbing £43,750, and a second quarterly dividend of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, will be paid on the 1st August, 1889, absorbing £52,500, leaving a balance of £2,465 1s. to be carried forward to the next account.

The company's repairing ss. *Minia* has been engaged during the past half-year in the repair of the Tricore cable, and the North and South Placentia cables, between Newfoundland and Nova Scotia; she has also repaired the Salcombe-Brest cable, on behalf of the Submarine Telegraph Company, and after undergoing certain necessary repairs in London, and taking in cable for the partial renewal and diversion of the St. Pierre-Duxbury section, completed that work on the 12th inst. With the exception of the Brest-St. Pierre cable, which was broken on the 17th inst. in deep water, the company's cables and land lines are in good working order.

The Paris Conseil de Perfecture, in March last, heard and gave judgment upon the technical legal points referred to them by the Court of Appeal in the action brought by this company against the Paris and New York Telegraph Company.

The decision of the Conseil is in effect that the joint purse agreements of 1880 and 1882 were beyond the authority given to the French company by its concession, and that the letter of the Minister of Posts and Telegraphs of 30th December, 1886, was in the nature o an official summons to that company to break such agreements.

The directors, after consultation with their legal advisers in Paris and London, decided to appeal to the Conseil d'Etat against this judgment, and the necessary steps are being taken for the purpose.

The increase of tariff from 6d. to 1s. per word, which came into operation on September 1st last, has approximately doubled the receipts without increasing the working expenses.

This result, so far, may be considered as fairly satisfactory, and leads the directors to hope that with freedom from interruption to the cables and increased business still further improvement may be reasonably anticipated.

The directors regret to announce the resignation, through failing health, of their colleague, Mr. William Barber, who has for many years occupied a seat at the board. Mr. Samuel Barber, his son, has been appointed to fill the vacancy thus occasioned during the remainder of the term for which his father was elected.

The Australasian Electric Light Company.

An extraordinary meeting was held on Tuesday last to consider the proposed sale of the property and assets of the company to the Anglo-American Brush Company.

Mr. B. H. von Tromp, the chairman, said that the great difficulty they had laboured under was want of money, and, in the absence of money, they were obliged to look round for a partner. They did so, and came into communication with the Brush Company. He considered, having regard to the position of the company, it was best to accept the formulated scheme and partake of the prosperity of the new company.

The resolutions were put to the meeting, which were agreed to *nem. con.*

A vote of thanks to the chairman terminated the proceedings.

The Falcon Engine and Car Works.

At the extraordinary meeting of this company, which took place last Tuesday, the scheme for the amalgamation with the Brush Company was agreed to.

Direct Spanish Telegraph Company, Limited.—This company's London telegraph station has been removed from 1, Leadenhall Street, to 74, Gracechurch Street. This station is in direct telegraphic communication by our cables with Bilbao and Madrid. All telegrams for Spain, &c., should be handed in at 74, Gracechurch Street.

TRAFFIC RECEIPTS.

The Brazilian Submarine Telegraph Company, Limited. The traffic receipts for the week ended 19th July, 1889, amounted to £4,167.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending 19th July, 1889, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,680.

MIX AND GENEST'S PORTABLE MILITARY MICRO-TELEPHONE.

THE "Mix and Genest" microphone, patented in all countries, possesses, in consequence of its special construction, the rare capacity of continually working well in any position, whereas many others can only be used in certain ways. This advantage has led the Berlin firm to the construction of a combined portable micro-telephone apparatus for military purposes, as shown in fig. 1.

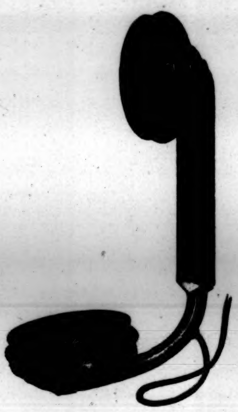


FIG. 1.

This combination instrument contains a micro-telephone (as a transmitter) connected with a telephone (as a receiver), so that simultaneously the first can be put before the mouth and the other to the ear, and the same combination has been in frequent use in the central stations of their town lines.

The portable instruments contain all necessary accessories, so that, after having been connected with the wire cords, they can immediately be put into action.

Messrs. Mix and Genest have been constructing two kinds of apparatus, differing only in the manner of call and by the weight and dimension of the complete apparatus. In one case the call is effected by an inductor with handle and alternating current bell, in the other the induction coil of the microphone in connection with a "Neef" hammer serve to create strong alternations, which puts the telephone of the called station into such vibration that the rattling sound is clearly to be heard even amidst the greatest noise. The latter construction without inductor and bell is not so heavy, and therefore more fitted for outposts and in the field in general, where the weight of the apparatus has to be taken into consideration.

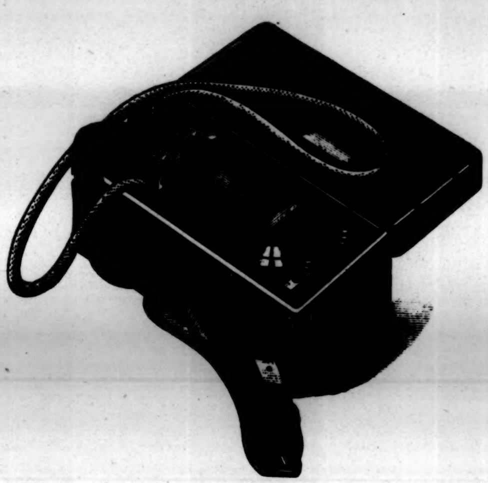
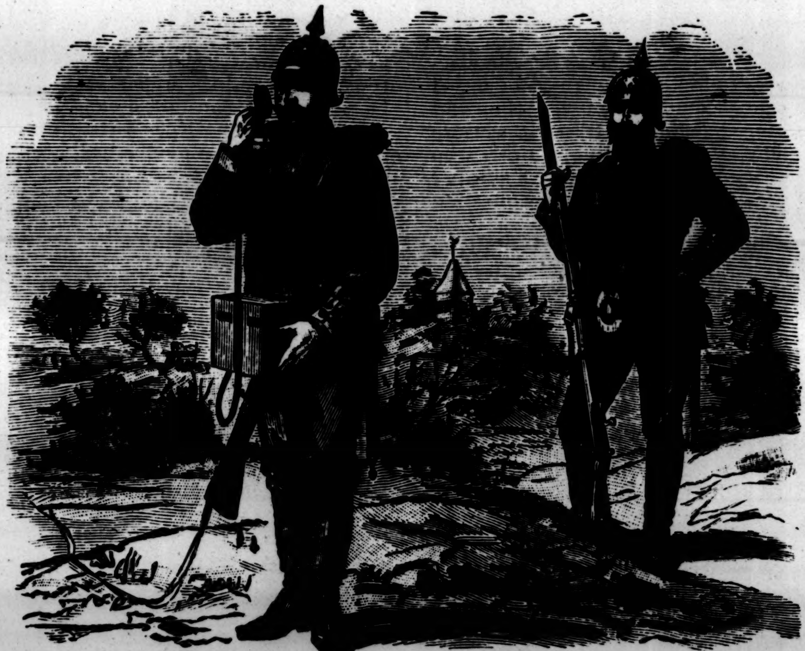


FIG. 2.



THE PORTABLE MICRO-TELEPHONE APPARATUS FOR MILITARY PURPOSES AS USED BY INFANTRY OUTPOSTS.

The last-named pattern, fig. 2, consists of an oak wood box, containing :—

1. The micro-telephone with contact lever. 2. The induction coil with "Neef" hammer. 3. The call button. 4. Two small dry elements. 5. Two binding screws. The box is provided with a broad leather strap for carrying the apparatus on the shoulder.

In order to render the apparatus ready for action it is only necessary to fix the conductors by means of the binding screws. The call is heard even when the box is closed. As soon as both apparatus are connected, the pressing of the call button on the left side of the box closes the local circuit of the dry elements by means of the primary induction coil and the interrupting hammer which acts immediately in sending strong alternations through the secondary winding of the induction coil into the line wire.

The second station having answered the call, the conversation can begin after having pressed down the contact lever on the inside of the handle of the micro-telephone, which has to be done during the whole conversation. After having ended the conversation and put the micro-telephone into the box, the spring holding the contact lever up interrupts the circuit of the battery, thus preventing the dry element from exhausting by too long work. No other parts of the apparatus being open but the contact lever and the micro-telephone, it is not easy to damage the parts or to disarrange the working.

We shall probably illustrate some further telephonic apparatus of this firm in a future issue of the REVIEW.

REVIEWS.

Electric Lighting with Reference to Municipal Government. By Dr. W. SCHRADER, Municipal Councillor in Halle on Saale, Magdeburg: Rathke. *(Die electrische Beleuchtung im Verhältniss zur Stadtverwaltung.)*

This book, as we learn from the preface, was originally written for private circulation among the members of the municipality and the officials of Halle, and in consequence of numerous requests it has been reproduced for general circulation. As might fairly be expected under such circumstances the author takes a decidedly judicial tone, neither advocating nor opposing the electric light, but fairly weighing all that may be urged for or against its introduction at any given time and place. He fears that his warnings will as little please the "fanatics of public electric lighting as those who hope to derive from the current not merely a shining light but shining gold." In proof that on this question "doctors differ," he cites an incident which has only quite recently become known. The town of Mannheim hesitated between the erection of a general central electric station and a single installation for the theatre. On taking the advice of two of the most eminent electricians, one recommended a central station and foretold if 10,000 lamps were established at the rate of $\frac{1}{20}$th of a shilling per hour for a 16-candle lamp, a net profit in five years of £4,850. The other expert warned the town against a central station unless the consumption of gas was restricted, and recommended the adoption merely of a special installation for the theatre.

Still, the author at the end of his introductory chapter remarks that the great part which electricity already plays in our public life will be greatly extended in the future. It is not conceivable that this development can become retrograde. He concludes his treatise with these words, which very well express his position:—"The electric light is certainly the light of the future, but it will be well not to enter upon its introduction with exaggerated expectations."

In his first chapter Dr. Schrader discusses the generation and storing of the electric current. Under this head he describes galvanic batteries, from which he entertains no immediate prospects of success; the thermopile, which has also hitherto proved practically a failure, the magneto-electric machine, the dynamo, and the accumulator.

The latter, the author suggests, may be made the means of utilising certain neglected sources of mechanical power, *i.e.*, that of waterfalls, of rivers, of the tides, the winds, and *the descent of heavy masses of rock which slide down from the mountains.* We can see little value in the proposal which we have italicised. The descent of rocks from mountains seems to us too irregular to be utilised by any conceivable form of machinery. Perhaps in Switzerland, in the Himalaya, the Caucasus, &c., the downward movement of glaciers might be made available.

In the following chapter the author treats of the production and distribution of the electric light, considering successively the glow light and the arc light, galvanic working, the arrangement of motors, working with currents of low and high tension, mixed working and working with accumulators. As an example of mixed working, the author mentions the electric installations in Milan. Steam is generated in nine boilers, supplying three systems of machinery. In the first place, 10 Armington-Sims engines, each of 135 horse-power and 350 revolutions per minute, set in action 10 Edison dynamos, each of which furnishes a current of 120 volts and 800–900 ampères. The currents feed the glow lamps and arc lamps in the houses. Secondly, four Armington-Sims engines, each of 60 horse-power, actuate each two Thomson-Houston dynamos (probably continuous current machines) furnishing a current of 1,750 volts and 10 ampères. These currents supply the arc lamps for street lighting. Lastly, two engines by Ganz and Co., of Pest, each of 150 horse-power, supply two Zipernowsky alternating current machines, giving a current of 2,000 volts and 30–40 ampères. These light up two remote districts, and especially two theatres situate therein.

The next chapter, which discusses the suitability of the electric light, is the most important. With respect to the agreeable character of the electric light, the author rejects the contention that gas can completely satisfy all our demands for artificial light. He recognises that the air is not robbed of its oxygen and contaminated with carbonic and sulphurous acids by electric lights. There is also an absence of the unpleasant heat which gas produces in the upper part of rooms, thus reversing the good old proverbial rule of "keeping the head cool and the feat warm." The author forgets also that gas, however cautiously burnt, gradually blackens the ceilings and the upper part of the walls. Nor does he refer to the constant flickering of gaslight, which is very annoying. Nor is its yellow colour agreeable, though to that the public has become habituated, just as it is has to chicorised coffee and to wines that have been plastered and "fortified." The electric light, on the contrary, allows the dyer and the tissue printer to match off his shades in foggy weather nearly as well as by daylight. We must, however, admit that in this respect the magnesium light is still better.

Among the dangers of the electric light, the author mentions that it darkens paper containing wood stuff. This complaint, originating in Vienna, will be recognised as foolish, when we find that its discoverer admits that daylight has the very same effect. Further, electric light and daylight discolour paper and dyed tissues only when spread out. But the sulphurous acid generated by burning gas destroys the colours and corrodes the fibres of textile goods even when lying rolled up on the shelves of warehouses. In like manner it rots both the paper and the bindings of books as they stand unopened in the library.

Injury to the eyes from the electric light depends not on its quality, but on its quantity, and here also excess must be avoided. It is impracticable to compare colours in direct sunlight, or in light coming from the region of the sky around the sun. The artist, the microscopist, and in like manner the "piece-looker" in dye works, always prefer a north light. It seems certain that an excess of light, even if unaccompanied by any abnormal heat, can prove injurious, both to animals and plants.

Next comes that essential and most difficult question, the cost of the electric light. Dr. Schrader admits that the expense is trifling in mansions, hotels, and factories situate near available water power. It is trifling also in works where mechanical power is constantly in use, so that no special boiler or engine is required. But the case is very different when an extensive inhabited territory is illuminated from a central station, especially if the light has to be supplied to places above 800 yards from the station. In such cases electric light may cost double as much as gaslight. This is especially the case where the light is not required every night. The results of actual working are often contradictory. The celebrated store, Bon Marché, in Paris, costs monthly 32,000 francs for the electric light, whilst with gas it was lighted for 24,000 francs per month, though much less brilliantly. The South Kensington Museum, on the contrary, shows a reduction of more than 50 per cent. by the substitution of electric light for gas.

The author complains, very justifiably, that but few calculations of expenditure from actual working have become known. The two electric light companies in Berlin have paid, respectively, dividends of 7 and 5 per cent., after all proper deductions. Still it would seem that these profits have accrued not so much from the supply of light as from the manufacture of glow lamps and from fitting up installations. The "Societá Generale di Elettricita," of Milan, has in its third year succeeded in paying a dividend of 4 per cent. In Lübeck the electric light, dispensed from a central station, has, so far, eventuated in a loss of 3 per cent. on the total capital. At Elberfeld a dividend of 4 per cent. has been paid.

The question whether the time has yet come for the general introduction of the electric light in any given town, turns, in the author's opinion, on three further questions :—1. Is the development of public electric lighting come, if not to perfection, at least to such a point that there is no ground for fearing lest the arrangements adopted may soon be superseded? 2. Are there already large public installations which, if they yield no great profit, are able to cover interest on capital, its gradual repayment, and the expense of wear and tear? 3. Have towns of a medium size to fear any special disadvantage from delay.

All these questions, the author thinks, must be answered in the negative. Hence, without seeking to pronounce any authoritative decision, he counsels delay.

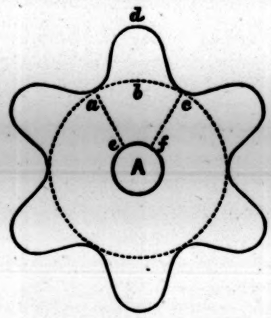
One advantage of electric lighting has been overlooked: a central station can be much more easily guarded than can gasometers, which have often been threatened by evil-doers.

Electro-Metallurgy Practically Treated. By **ALEXANDER WATT.** Ninth edition, enlarged and revised. London: Crosby Lockwood and Son, Ludgate Hill.

This book (one of the Weale's series) is so well known that but little requires to be said about it. The author has rewritten the introduction, and made numerous alterations which were necessitated by recent improvements in the construction of dynamo-electric machines, and in certain processes of the art. A number of practical notes have been added, together with some useful tables.

On looking through the book, we find at page 198 a description of a form of battery which the author states he designed, and which he says may be useful to the electro-gilder. The special point in this battery consists in the use of a corrugated copper cylinder, which the inventor states will, in consequence of the large surface it exposes, give a greater quantity of current than would be the case if a plain cylinder were used. With reference to this, Mr. Watt has evidently not heard the story of King Charles and the Royal Society, as follows :—The monarch submitted for solution to the learned members the problem: Why a pail of water with a live salmon in it weighed less than the pail of water without the salmon. After a prolonged discussion, it was suggested by an intelligent member that it would be advisable to make an experiment on the subject, the result being that the continuation of the discussion was postponed *sine die*. Now, Mr. Watt evidently could not have made any measurements of his improved battery, otherwise he would not have made such an absurd statement on the subject as he has. As a matter of fact, however, the notion that a corrugated surface, when employed in a battery, in virtue of its area being great reduces the resistance of the battery, has been again and again brought forward, and we therefore take this opportunity of proving the absurdity of the idea.

In the fig., let A be the centre zinc rod or cylinder, and the dotted circle an outer copper cylinder, and let the sinuous line represent a corrugated cylinder; then if we have, say, six corrugations as shown, and if we suppose the space between the circle, A, and the dotted circle to be divided into six segments, of which *a*, *b*, *c*, *f*, *e*, is one, it is obvious that the actual resistance between the cylinder, A, and the dotted cylinder will be one-sixth of the resistance of the segment between the surfaces, *e*, *f* and *a*, *b*, *c*. Now, the resistance between the surfaces *e*, *f* and *a*, *d*, *c*, must be equal to the resistance between *e*, *f* and *a*, *b*, *c*, *plus* the resistance between *a*, *b*, *c* and *a*, *d*, *c* (the total resistance being one-sixth of this). According to Mr. Watt, however, the resistance between *e*, *f* and *a*, *b*, *c*, plus the resistance between *a*, *b*, *c* and *a*, *d*, *c*, is *less* than the resistance between *e*, *f* and *a*, *b*, *c*, which, as Euclid says, is absurd. Mr. Watt and others seem to forget that resistance is a function of length as well as surface. It matters not what form the plates have, *i.e.*, flat or round, the same argument as the foregoing will still apply as regards corrugating the same. If we take the case where the volume enclosed by the corrugated cylinder is the same as that enclosed by the perfect cylinder, then the resistances in the two cases are nearer an equality, but still in favour of the perfect cylinder. The only argument that could be advanced in favour of corrugations is that owing to the larger extent of surface the current density may be less, and this in the case of Leclanché batteries might reduce polarisation. There is probably a fallacy in this also, however, as experiment certainly does not prove that any advantage is gained; the cause of this is, no doubt, due to the fact that although the mean density is diminished by the larger surface, the density is unequally distributed, being greater at some portions of the plate than at the others.



Traité Théorique et Pratique D'Electrochimie. By **DONATO TOMMASI.** Parts 2, 3 and 4. Paris: E. Bernard & Cie., 53, Quai des Grand-Augustins.

These three volumes are a continuation of the treatise which we noticed a few months ago. The amplitude with which the author is treating the subject may be gathered from the fact that the last page of the 4th part is numbered 960 (the paging commences at the 1st part and is continued throughout the parts). The work, which is to be continued, is undoubtedly the most exhaustive of the kind yet compiled, and the author deserves great credit for what must have proved a most laborious task. A good index, when the whole is completed, will be a most necessary addition.

Shop Lighting Tenders Wanted.—Messrs. Charles Baker & Co., 271 and 272, High Holborn, invite tenders for continuing the electric lighting of some of their premises, either with small separate plant fitted on the premises or from some large centre. All applications to be from principals, by letter, addressed as above. Surely this firm was formerly supplied by the Whetstone Park Station of the Pilsen-Joel Company? Why is it now necessary to ask the assistance of others?

EXECUTION BY ELECTRICITY.

The following extracts from the New York *Herald* of July 12th may prove of interest to our readers:—

"F. L. Pope, ex-president of the Institute of Electrical Engineers, and now in the employ of the Westinghouse Electric Company, was called as an expert before Referee Becker yesterday to show that the electrical appliances recently purchased by the State for the execution of condemned murderers are by no means certain to cause an instantaneous and painless death. His opinions differed radically in many respects from those of expert Harold P. Brown, whose testimony occupied the first three days of the reference in the *habeas corpus* proceedings begun on behalf of William Kemmler.

"Mr. Pope said he was familiar with almost every branch of electricity, but that he had not observed the effects of currents on living organisms to any great extent. He declared that he did not think it possible to determine the resistance of a person to be executed with much accuracy by means of the Wheatstone bridge. Inanimate objects, such as metal, could be measured with perfect accuracy by the bridge. To test the bridge, Mr. Pope endeavoured to measure his own resistance yesterday morning before going to the reference. He took hold of two metal electrodes of about half an inch in diameter, and used a solution of sulphate of zinc as moisture. Four tests with a different voltage each time gave as many different results. The first test with one volt pressure showed 6,300 ohms resistance, 10 volts reduced the resistance to 5,140 ohms, 50 volts gave 3,850 ohms, while 100 volts brought the figure down to 3,500. In determining the resistance of an inorganic substance, the result would not vary whether the voltage was 1 or 100. The chemical action of the electricity on the fluids of a living body would account for the inaccuracy of the Wheatstone bridge in such experiments.

"Mr. Pope testified that the Westinghouse dynamo, such as the State has purchased, has a maximum capacity of 1,050 volts. The voltage of the dynamo can be increased to almost any extent, but the machine is liable to burst if it is done.

"Mr. Pope thought that the electromotive force of lightning was infinitely greater than that of electricity generated by artificial means, though in volume it might be equalled. Electricians could not blow a broom to pieces, much less a church steeple. It would be impossible for them to tear a coat from a man's back, though there are many records that lightning has played such tricks.

"There is very little definite knowledge upon the effect of powerful electric shocks upon the human body, though physicians have studied the effects of weak currents. When people have been struck by lightning they have generally been knocked senseless and their skin has been badly burned. If their clothes are soaked with rain they act as partial conductors, and are perhaps sufficient to cause burns. For electrical executions moistened pads are to be placed between metal electrodes and the flesh, as the liquid forms a better connection than the metal, and facilitates the passage of the current. Mr. Pope did not feel at all sure that the subject would not be burned even with the pad between his skin and the electrodes. The heat would probably make the water boil in any event. With a Westinghouse dynamo a pint of water could be boiled in very few seconds. If the moisture dried a sufficient current would carbonise a man's body from one end to the other.

"'In your opinion would a current of 1,050 volts be sufficient to kill a man?' asked ex-Congressman W. Bourke Cockran.

"'In my judgment,' was the reply, 'that would depend upon the susceptibility of the subject and upon the contact. What would kill one man might, perhaps, only slightly injure another.'

"'Would the atmospheric conditions make any difference?'

"'Only to a small extent. If it was damp the subject might make a contact with the earth, while if it was dry he would be partly insulated.'

"In reply to questions put by District-Attorney Quinby, of Erie county, Mr. Pope said that the Westinghouse Company naturally objected to having its dynamos used for electrical executions, as the effect would be to make the general public believe that they were unsafe for commercial use. He thought it would be possible to kill a man painlessly by means of the alternating current, but he did not think that death would be certain. He thought that death by electricity would be painful as a general thing, though he admitted the current was quicker than the nerves could carry sensations. Mr. Pope was of the opinion that while the Wheatstone bridge might accurately measure the resistance of a body at the time the test was made, the measurement might not hold good two minutes. Of course, he did not deny that the machines owned by the State might kill the condemned men, but he thought it possible that they might not kill. Everything would depend upon the susceptibility of the man. Nothing is definitely known of the fatal effects of the currents except through Mr. Brown's experiments on dogs, calves and horses, and it is admitted that lightning is less fatal to man than to the lower animals. He thought it very likely that the alternating current to be used was more dangerous than the continuous current.

"'Could you, as an expert, describe accurately a current of sufficient intensity to cause death?' asked Mr. Cockran.

"'I don't know that I could name a current that would absolutely cause death in every instance,' the witness concluded.

"The reference was then adjourned until Monday morning. To-day several of the lawyers interested will visit Mr. Edison's laboratory to see the apparatus with which Expert Brown made his experiments."

THE ELECTRIC LIGHTING SCHEMES.

Bills before the Commons Select Committee.

Provisional Orders Confirmed.

(*Continued from page 68.*)

Mr. Freeman said, as he understood that some alterations had been made in the Order of the London Electric Lighting Company, he should like to have a copy of the amended Order, or he would be unable to cross-examine Lord Crawford, and should ask that the Committee might adjourn.

The Chairman: In the case of important amendments there is no doubt they ought to be before the Committee. It will be highly inconvenient to adjourn this Committee, but, of course, if counsel says he requires time to examine these amendments, then we shall be obliged to adjourn.

Mr. Freeman: I do not think I will, under the circumstances, take upon myself the responsibility of asking you to adjourn, considering the lateness of the session.

The Chairman: You are, Mr. Freeman, taking a course which the Committee think is very proper, and I hope you will not be put to any inconvenience.

Mr. Moulton proceeded with his examination, and asked if there was any evidence at the Board of Trade enquiry which pointed to any special circumstances rendering it unadvisable that this parish should have electric light.

Lord Crawford: There was nothing in the whole enquiry to show that St. Margaret's should be treated in a different manner to other parishes, or that the people of the district did not require the light.

Mr. Pope: I see that the Board of Trade intimated that the vestry declared their wish to retain in their own hands the power of supplying electric light in their own district. Is it your view that that is a reasonable thing for a local authority to desire?

The Witness: I know nothing of their desire to do so. They never stated so to me.

Does it not accord with your views that the lighting of the district might be reasonably desired to be done by the local authority?—If the local authority show their intention to do so.

If it were a *bonâ fide* intention, it would be a reasonable contention on the part of the local authority?—Reasonable so far as they are concerned, but I think undesirable so far as the ratepayers are concerned.

And unreasonable so far, of course, as to the company going into the district?—Yes, if they are to have a monopoly.

Mr. Freeman: Since the matter came before the Board of Trade, you have had various interviews with the members of the London County Council?

The Witness:—Yes, I have seen them several times.

And they have submitted to you several points in which they consider your Provisional Order is defective?—Yes.

To the clause which states that nothing in your order shall authorise the undertakers to break up or otherwise interfere with any embankment, park, or open space for the time being vested in the Council, there has been added the word "sewer?"—Yes; we have no objection to that.

Up to the present time the counsel are in ignorance of your plans for carrying the mains over Westminster Bridge?—Except in general terms.

You have not sent in any plans?—I am not in a position to submit plans until we obtain a Provisional Order. We have not yet been asked to send in plans.

Supposing it is physically impossible to go under some part of Westminster Bridge?—You cannot say it is physically impossible.

But I do say so. Supposing then that it is a matter of great inconvenience, should you have the power to override a public body?—If a public body is to stand in the way of a great demand, I think I should be justified in asking Parliament to override it.

Clause 48 regulates the price which you are entitled to charge for your supply. We are not going to seek to interfere with your price, so Mr. Moulton need not be so anxious; but have you any reason for objecting to a clause being inserted for the auditing of your accounts in the same way as under the Gas Acts?—Yes.

Why?—It is a new clause. I have not seen it until this morning. I have a *prima facie* objection. I consider it is inquisitorial, and the question does not affect the County Council at all.

If the charges are improper, how is that to be ascertained unless there is the opportunity of looking at the accounts? Do you seriously object to such a clause?—Yes, I do.

Would you be surprised to hear that this proposed clause is taken verbatim from the Gas Acts?—It is not taken from any Act that I am aware of.

It is in the City of London Gas Act, 1868.—That is a private Act.

It is a general public Act—an Act to amend other Gas Acts, and to make provision for regulating the supply of gas to the City of London, and you will find a clause there almost verbatim the same as the one proposed. Does not that modify your view that this is a very reasonable thing to ask for?—No.

Mr. Moulton: When the prices were revised there would be an enquiry before the Board of Trade, and of course any investigation into the accounts which was necessary the Board of Trade could then direct?—Yes.

Mr. Pope remarked that he had not yet said a word about the gas clauses in the order, as he desired that they should be considered apart. There were provisions formulated by the Board of

Trade, but they were not satisfactory to the gas companies, and he should at the proper time submit a regular series of clauses and give reasons in support of them.

The Chairman: How often do you cross the river?

The Witness: Three times—at Cannon Street, Blackfriars, and Charing Cross. We have no statutory powers to cross the river except what are stated in the report of Major Marindin.

The Chairman: I should like you to carefully consider the question of audit.

Having explained, in answer to Mr. Story-Maskelyne, the system of supplying the electric current from Deptford and converting it for household use, the Witness stated, in reply to Sir Henry Roscoe, that he had considered other means of crossing the river than by means of the bridges. At present, they had no authority to go on to the land on the north side of the river.

Sir Henry Roscoe: What objection is there to going under the river?

The Witness: There would be a great risk.

Could you not sink and insulate?—It would be a very risky thing to do, because there would be some danger from the anchors of barges.

You have considered the question?—Oh, yes.

Mr. Moulton pointed out that by the order, the undertakers should not be authorised to place their mains in, under, or over the River Thames, or in any way affect the powers of the Conservators. The company must take their mains above bridge. With regard to the question of the bridge, the Metropolitan Company did ask for compulsory powers.

Mr. Story-Maskelyne: But the bridge to which you refer is a public bridge.

Mr. Freeman: I shall have something to say about Waterloo Bridge, for my objection is not only to Westminster. There are structural questions arising as to both bridges, as well as the question of policy.

Mr. Pope then said that the question was, whether the committee were justified in withdrawing from the local authority the statutory power given to them. Parliament had clothed them with a certain right, and although the Board of Trade had waived their consent, he did not think, under the circumstances, the committee could support that. The question was, leaving the case as it stood, supposing they were of opinion that it would be desirable that the vestry should consent and so they ought to allow the district to be taken because it was easier, were the committee prepared, because of that, to deprive the vestry—the local authority—of that which Parliament had given them, namely, the right to veto the introduction of electric light if they chose? That was the question he must ask them to decide, and the committee could not escape from it. If they were satisfied that the vestry dissented—if they were satisfied that the Board had not disclosed sufficient reasons, they must be bound by the decision of the committee. Were they going to have the great nuisance of the streets being broken up first by one company and then by another, and was it not certain that if the power of supply was given to that company there would be a constant disturbance of the streets. The exercise of the discretion on the part of the local authority was only a reasonable one. Although it might appear a hard thing to dislocate the arrangements of the promoters, there could be no escape from the position that the proper course for a committee of Parliament to take was, that if they were not satisfied that the preliminaries necessary for the granting of a provisional order were not complied with there was no alternative but to decline to confirm the order.

The room was then cleared whilst the committee were consulting, and upon re-entering,

The Chairman said: The committee have come to their decision, and they confirm the Provisional Order, subject to conditions hereinafter to be laid down with regard to the audit of the finances of the company to the satisfaction of the County Council, as to the Westminster Bridge, and as to a reasonable supply of the demand for electrical energy. Those are the points on which the committee feel strongly.

Some little discussion having taken place as to the procedure in the other cases,

The committee adjourned for the day.

Upon the Select Committee of the House of Commons resuming their sitting on Wednesday, July 17th,

Mr. Pope, Q.C. (who represented the Vestry of St. Margaret and St. John, Westminster) observed that, in regard to the order granted to the London Electric Supply Corporation, inasmuch as the committee had decided in favour of the preamble, he would offer no further opposition until the Bill reached the House of Lords. In the meantime his clients vehemently, but silently, protested. (Laughter.)

Mr. Saunders, Q.C. (who appeared on behalf of the Westminster Electric Supply Corporation), said that in many respects the company was very similar to the London. It differed, however, in regard to capital, for it was only a modest company, created simply for the purpose of dealing with two districts with a capital of £100,000. The district they proposed to light comprised two parishes. In the parish of St. George, Hanover Square, they wished to light Hanover Street, Hanover Square, Brook Street, Upper Brook Street, George Street, Conduit Street, New Bond Street, Old Bond Street, St. James's Street, Piccadilly, Park Lane, Hamilton Place, Mount Street, Grosvenor Place, Upper Belgrave Street, Lower Belgrave Street, Buckingham Palace Road, St. George's Road, Lupus Street, Victoria Street, and Wilton Road. In the parish of St. Margaret and St. John the Evangelist, Westminster, they proposed to light Victoria Street and Broad Sanctuary. The whole of St. George's, Hanover Square, district was common to his company and the London Company, and they were unopposed. Except in one or two instances the southern district was not a rich district, for, although it included the Houses of Parliament, he did not think that would be any advantage to the company, as doubtless the House would supply their own light. Virtually the poor district of Westminster was provided for by his company, and they did not look to that part for any valuable lighting purposes. They rather looked to St. George's, Hanover Square, as being most likely to give them a good demand for the light, but they were ready to take the good with the bad, and accept the area which the Board of Trade had given them. They rather looked to the Westminster district as giving some demand for electricity as a motive power. The system proposed to be adopted by his company differed from that of the London Company. Theirs was to be a system of low tension and continuous currents, and that was one of the grounds why the Board of Trade gave his company and the London powers over the same area. There was a very special reason why the Vestry ought to have given consent to his company, and that was that the company had incurred considerable expense in putting up a station for the purpose of supplying electricity to the district, and all that money would be as good as wasted if the Order was not granted. At the time of the holding of Major Marindin's enquiry £8,000 had been spent, and by this time that sum must have been increased. He would be able to prove to the committee that in a very short time that station would be in a position to supply as much electricity as would be wanted in the district. They were far advanced with their works, and besides causing a waste of money, it would be a great shame if the vestry were to be allowed to prevent them utilising the works as they proposed. The company, he would point out, was a very responsible one, the directors including Sir John Heron Maxwell, Mr. Kimber, M.P., and Mr. Hayes Fisher, M.P.; and the whole capital was guaranteed, and could be raised at any time that it was required. Consent should be given to the Order, because there was a great demand for the electricity, and they were in a position to supply the want. There would be no question between the company and the County Council as to bridges, for they did not propose to come across any bridge. The system they proposed to adopt had been in practical operation in the West End for two or three years—being practically the same system as that of the Kensington and Knightsbridge Company. To show how inconsistent the vestry was in their opposition, he mentioned that they had actually consented to the Kensington and Knightsbridge Company taking a Provisional Order in the detached portion of their parish. In conclusion, Mr. Saunders announced his intention of calling witnesses in support of his case.

The Chairman: I don't think there is any necessity for calling any witnesses; at least, that is the opinion of the Committee. We know the position of the company from what you have said.

Mr. Saunders: If that is so, I will simply ask you to say that the preamble is approved.

Mr. Pope, Q.C.: I wish to say that my position is one of silently protesting. (Laughter.)

The Chairman: This Provisional Order is confirmed.

Mr. Claude Baggallay, speaking on behalf of the House-to-House Electric Lighting Supply Company, Limited, said that as the preamble of his Order was not opposed, he did not think he need go into the case at any length. The system was the same as that already described by Mr. Pember and Mr. Saunders, when they spoke on behalf of their respective Orders. The area, as set forth in the second schedule, comprised Richmond Road, Earl's Court Road, Kensington Main Road, Warwick Road (with the exception of that part lying to the North of West Cromwell Road), Philbeach Gardens, Penywern Road, Earl's Court Square, Colherne Road, Redcliffe Square, Fulham Road, Tregunter Road, Boltons, The Grove, Gilston Road, Priory Road, Evelyn Gardens, Evelyn Terrace, Cranley Gardens, Old Brompton Road, Queen's Gate, Onslow Gardens, Onslow Square (west side), Cromwell Road, Wetherby Road, Bramhan Gardens, Warrington Gardens, Barkstone Gardens, Collingham Road, Ashburn Place, Bina Gardens, Courtfield Gardens, Courtfield Road, Marloes Road, Lexham Gardens, West Cromwell Road, Warwick Gardens, Ladbroke Grove, Ladbroke Grove Road (as far as St. Charles Square), Uxbridge Road, Royal Crescent, Lansdowne Road, Lansdowne Crescent, Cornwall Road (from Portobello Road to Ladbroke Grove), Lancaster Road (from Portobello Road to Ladbroke Grove), Elgin Crescent, Elgin Road, Ladbroke Gardens, Archer Street, Colville Square, Powis Square, Cambridge and Oxford Gardens, Bassett Road, St. Mark's Road (north of the railway bridge), and St. Charles Square.

The Chairman then said that the preamble of the company was approved.

Mr. Saunders said he had to ask the Committee to approve the preamble of the Kensington and Knightsbridge Company's Order. The district comprised a portion of two parishes. Neither of the vestries were opposed to the Order. The capital of the company was £250,000 divided into £5 shares; Mr. Crompton was the engineer and Sir Frederick Bramwell was one of the directors.

The Chairman: Have they done any work yet?

Mr. Saunders: Oh yes. They have got two licenses, and they have been working at the western end of Kensington High Street. Among other places the Town Hall is lighted by the system, and they have been at work two years without a failure of any kind. They are only waiting for this Order to increase the size of their generating stations so as to be in a position to give a larger supply.

Sir Henry Roscoe: Is it the alternating or the direct system?

Mr. Saunders, Q.C.: It is the direct continuous system.

The preamble was approved.

Mr. Wallace then addressed the Committee on behalf of the Notting Hill Electric Lighting Company. The capital of the company was, he said, £100,000, and Prof. Crookes was chairman of the board. The system to be adopted was the same as that of the Kensington and Knightsbridge Company, and they also had the same engineer—Mr. Crompton.

Mr. Story-Maskelyne: What pressure do you put on your wires?

Mr. Wallace: In the streets 100 volts. If the three-wire system is used the pressure will of course be correspondingly increased. In the mains the pressure will be 200 volts.

The Committee confirmed the preamble of the Order.

Mr. Sidney Morse spoke next on behalf of the Chelsea Electricity Supply Company. The company, he said, intended to use the direct continuous system. The necessary capital was subscribed, and the only opposition was from the Gas Light and Coke Company and the London County Council.

The Order and the preamble were confirmed.

Mr. Morse said he also appeared for the Metropolitan Electric Supply Company. The area of the company he said included a good deal of the parks.

The Chairman: Is the company supplying?

Mr. Morse: No sir, it is not.

The Chairman: Does the Strand fall into this district?

Mr. Morse replied that a considerable portion of the Strand was comprised in the area.

The Chairman remarked that the Committee wished to call Mr. Morse's attention to Major Marindin's report wherein he referred to the Chelsea Company.

Mr. Morse said he thonght he could satisfy the Committee why Major Marindin did not recommend the Order. Prior to the enquiry his clients had made representations to the Board of Trade, and as they understood satisfied the Board as to the capital. They further understood it was not necessary for them to go into the matter in detail before Major Marindin, and consequently the Major seemed to think that on technical grounds there was reason for not granting the Order.

In answer to a question put by the **Chairman**, **Mr. Morse** said the Electric Supply Corporation was a totally different company from the Electrical Power Storage Company, although it was composed of practically the same persons.

The Chairman said he would take it for granted that the Board of Trade would not have granted the Provisional Order unless they were satisfied on that point. The preamble of the Order would therefore be approved.

Mr. Cripps addressing the Committee on behalf of the Metropolitan Company's Order, said it originally comprised a Mid-London Order, a West London Order, and a South London Order. There had been some difficulties in regard to the South London Order with the local authorities, aud that Order had been withdrawn. Therefore, they only wanted the preamble for the West London and the Mid-London Orders. He believed there was no opposition to those two Orders, all the local authorities having agreed to them.

The Chairman stated that the Committee would confirm the Order.

Mr. Cripps said there was one other matter, and that was the Metropolitan Electric Supply Order. The preamble was unopposed.

The Chairman: I see Waterloo Bridge is comprised in the area.

Mr. Cripps: That is so. He added that they had stations situate at convenient places for supplying the district they proposed to light.

Mr. Story-Maskelyne: Are any of the stations at work?

Mr. Cripps: Yes, the one in Oxford Street and the Whitehall station has been at work for some time.

The Chairman: I understand there is no opposition.

Mr. Cripps: No.

The Chairman: We confirm the Order, then.

Mr. Freeman, Q.C. (on behalf of the London County Council), said that in consultation with his friends they had decided upon a clause being put into the Orders in reference to the accounts of the companies. The clause he wished inserted was as follows:—"The accounts to be rendered by the undertakers under the 9th section of the principal Act shall be examined and audited from time to time by such competent and impartial persons as the Board of Trade shall from to time appoint."

Mr. Saunders, on behalf of his clients, said they thought that a very proper clause.

The Chairman pointed out that the clause did not provide for the payment of the audit.

Mr. Moulton thought he could make a proposal that would meet that difficulty. His clients would consent to add to the clause the words, "and the undertakers shall pay the reasonable expenses of such audit as fixed by the Board of Trade."

Mr. Freeman considered it desirable that some words ought to appear saying how it should be paid.

Mr. Moulton: Surely you would not require that. There would be no difficulty in that respect.

Mr. Freeman still objected that there was nothing to say who should pay the money and from whom it could be recovered.

Mr. Moulton: Surely, if you say that the companies must have the audit, the Courts are strong enough to get payment.

After some further discussion the clause was agreed upon, with the understanding that the shareholders of the company should pay the expense of the audit.

The Chairman stated that the clause would be put into each Bill separately.

Mr. Freeman said there was another clause that was practically agreed upon. In clause 4 of the London Company's order, they proposed to strike out the last three paragraphs of that clause, and put in these words: "No part of the undertaking shall be transferred (except as hereinafter expressly authorised), nor shall the undertakers purchase or acquire the undertaking of or associate themselves with any other company or person supplying or intending to supply energy under any licence, Provisional Order, or Special Act within the administrative county of London, unless the undertakers are authorised to do so either by Provisional Order under the principal Act or by a special Act." What the County Council wished was to guard against any amalgamations taking place before the public had time to state their objections. They regarded amalgamation of two of these large companies as of as much importance as the issuing of a fresh order.

Mr. Moulton did not see the least necessity for such a clause, as he considered provision was already made for amalgamation in the order. The Board of Trade had carefully considered the point, and they had amply safeguarded the public in the order.

Mr. Freeman remarked that on Tuesday Lord Crawford said he was perfectly willing to agree to such a clause, and he was therefore at a loss to know why his counsel was now opposing it.

The Chairman: Does this clause proceed from the County Council?

Mr. Freeman: Yes.

The Chairman: Subject to any verbal alterations that may be necessary, we approve the clause.

Mr. Gray, on behalf of the Board of Trade, opposed the clause, as he said it went practically in the teeth of section 11 of the principal Act. In that Act Parliament had appointed the Board of Trade as the authority to give consent to amalgamation.

Mr. Freeman said that Mr. Gray was under an entire misapprehension. The clause he had proposed relative to amalgamation had nothing whatever to do with section 11 of the principal Act. As the clause had been approved by the Committee, and accepted by the promotors, and was satisfactory to the County Council, he failed to see why the Board of Trade should object.

The Chairman reminded Mr. Freeman that they only accepted the clause subject to any modifications that might be agreed upon.

Mr. Gray said there was one other point which the Board of Trade desired him to mention, and that was how far that clause would interfere with the Board of Trade in granting licences.

The Chairman remarked that he was bound to say the Committee felt that they could not discharge the responsibilities cast upon them unless they saw that no amalgamation of any two important companies could take place unless in the fullest light of day, and with the sanction of Parliament.

Mr. Gray stated that the Board of Trade had the power of granting licences without applying to Parliament.

Mr. Story-Maskelyne: But that is only for a very short period that they can grant licences.

Mr. Gray: For a period of seven years.

Mr. Freeman said the clause would not in any way interfere with the Board of Trade in granting licences. It only related to the amalgamation of any two companies.

Mr. Moulton pointed out that the effect of the clause would be to restrict any two companies temporarily associating together in case of a breakdown.

Mr. Baggallay also referred to the same matter, and said that in the event of a breakdown, consequent on an explosion or any other mishap, the clause would work great harm to the public, as it would prevent one company temporarily assisting another.

After consultation, **Mr. Freeman** said he had been able to satisfy the London company with regard to the clause by inserting a provision that the clause should not prevent any temporary arrangements under which the undertakers might obtain from any other company a supply of electricity. The only proviso was that before doing so they should get the consent of the Board of Trade and of the County Council.

Mr. Wallace, on behalf of the three companies he represented, could not agree to the clause. The clause could hardly affect the London company, for they had no other company within their area from whom they could obtain a temporary supply.

Mr. Baggallay also opposed the clause.

Mr. Moulton did not see that it could be any advantage to the County Council that there should be so much delay in the matter. It seemed to him unreasonable that the companies should have to wait two years, or thereabouts, before any other company could associate with them.

Mr. Freeman pointed out that the rider to the clause was inserted on the suggestion of Lord Crawford.

Mr. Cripps said that if it was only a question of amalgamation they would not object to having to get the consent of Parliament and the other bodies, but when it was simply a question of associating for temporary assistance they strongly objected to the waste of time and the expense involved in going before Parliament. It really meant that they would be crippled in their business for no reason whatever. After all, the electric lighting companies were doing their best to introduce a new industry, and, therefore, why should they be hampered with such clauses—clauses which were never insisted upon in any other trading or commercial companies? By the clause any single agreement with any other company would have to be brought before Parliament.

Mr. **Moulton** stated that the clause put his company under a special disability, and he could not see any reason for it.

The **Chairman**, after consultation with his colleagues, said they were compelled to accept the clause practically as it stood with the rider as to temporary assistance in case of sudden emergency.

The **Chairman**: Then there is the question of Westminster Bridge.

Mr. **Moulton** next observed that the County Council proposed to insert a clause making it unlawful for the undertakers to break up or interfere with any bridge vested in the Council, except in accordance with plans and particulars previously submitted to the Council. In case the approval of the Council was not given the point was to be arbitrated upon. The company he represented felt it was absolutely necessary that the mode of carrying the mains across the bridges should be arbitrated upon by some competent person. It would be to the interests of the undertakers to fall in with any reasonable suggestion of the County Council, but if they could not agree it was most important to the public that the matter should be arbitrated upon by some competent and impartial person. He would suggest the President of the Institution of Civil Engineers as being such a person.

Mr. **Cripps** mentioned that a similar point was raised by the company that would cross Waterloo Bridge—whether the matter should be open to arbitration or whether they should be under the absolute control of the County Council. He thought that all local authorities should be on the same footing, and the County Council ought not to be in any different position from the other local authorities. It was not right that the Council should have the absolute power of preventing them crossing Waterloo Bridge.

Mr. **Cripps** was of opinion that the special clause was quite unnecessary, because the matter was dealt with in the general provisional order, the arbitrating power being the Board of Trade. He should therefore strongly oppose it.

Mr. **Freeman** said that with regard to the bridges, the County Council were in a very peculiar position. By the Act of 1887, the then Metropolitan Board of Works were given power to free all the bridges of London which were not already freed, and they were to purchase the undertakings, which were afterwards to be transferred to them, and the roads were to be repaired by the Board, the only exception being tbe Embankment, which was repaired by the local authorites. Owing therefore to the peculiar position in which they stood in relation to the London bridges it would be most prejudicial and dangerous if final control in the matter were given to anyone but the County Council.

The **Chairman**, whilst acknowledging the great responsibility of the County Council in the matter, said the committee still thought that the companies ought to be allowed to cross the bridges, with proper safeguards.

Mr. **Freeman** added, that what the County Council wanted was the power to altogether stop the companies going across the bridges, if necessary. They were to be the judges, first of all, of whether it was practical to cross the bridges, and secondly, as to at what point, if any, they should be crossed. The Council had the very strongest feeling that if any interference was to take place with the bridges, it should be entirely under their control. At present, they had no means of judging whether it was necessary that the mains should cross the bridges, or whether by the expenditure of a little more money they could not do without laying mains over the bridges. If the Council saw that it was both practicable and reasonable that the companies should cross the bridges, they would be ready to co-operate with them in the work.

The **Chairman**: Under what circumstances did the gas companies lay their pipes over the bridges?

Mr. **Freeman** replied that the pipes over Westminster Bridge were laid by special arrangement, and they were formed in a totally different manner to any other gas pipes in order to meet the wishes of the owner. He should ask the committee to follow the precedent that Parliament had always set in regard to bridges, viz., give the entire control of them to the owners without making any provision for arbitration. If there was to be an arbitrator, he would rather the matter be referred to Her Majesty's First Commissioner of Works.

The **Chairman** said the committee had considered the question, and in giving their decision he would draw attention to the decision they gave on Tuesday on the subject of crossing the bridges. While they were ready to give every possible guarantee and satisfaction to the County Council as to the method in which the bridges should be crossed, they gave it to be understood that they were to be crossed. They considered Mr. Freeman's proposal as a last resort and one which would practically give a *veto* to the County Council. They wished to give the very greatest latitude to the County Council in the selection of an arbitrator, but it was plain that some arbitrator would have to be appointed, whether by the Board of Trade or anyone else.

Mr. **Freeman** stated that he would accept that decision at once, and endeavour to carry it out. But if on further consideration of the matter the County Council felt that it was very important that the arbitration should not be put upon them, then he reserved his right of pursuing the matter further. But he would now propose a clause providing for the carrying out of the arbitration. They felt it most important that the arbitrator should have the whole facts and materials before him, and have an absolutely free hand in giving his decision. They therefore proposed that the following clause should be inserted:—"Provided that if within 28 days after the submission of such plans, sections, and particulars to the said Council, with notice in writing requiring them to approve the same, the said Council shall disapprove or fail to approve such plans, sections, and particulars, then such plans, sections, and particulars shall be referred to an arbitrator to be appointed by Her Majesty's First Commissioner of Works, on the application of either the said Council or the undertakers. Such arbitrator shall consider and determine 'whether, having regard to the possibility of avoiding such method of crossing by any other practicable alternative, and to the structure and design of the bridge, and to all other circumstances of the case, any such crossing should be allowed, and, if so, shall fix and determine' on what terms and conditions, and in accordance with what plans, sections, and particulars, such crossing should be allowed; and 'in the event of the arbitrator allowing such crossing, then' the undertakers shall be bound to comply with and observe all the terms and conditions imposed, and the plans, sections, and particulars approved by such arbitrator."

Mr. **Duncombe**: But, Mr. Freeman, we have decided that the bridges shall be crossed.

Mr. **Moulton** said that if the words "whether, having regard to the possibility of avoiding such method of crossing by any other practicable alternative, and to the structure and design of the bridge, and to all other circumstances of the case, any such crossing should be allowed; and, if so, shall fix and determine on," and "in the event of the arbitrator allowing such crossing," were struck out, he should not object to the provision.

Mr. **Freeman** could not accept Mr. Moulton's suggestion, as that would give the arbitrators too much power.

The **Chairman**: We are quite willing to give the arbitrators the very fullest power as to the method of crossing, but they could not let them veto the crossing.

Mr. **Cripps** accepted the proposal of Mr. Freeman, if the words as to the power of the arbitrators to prevent them going across the bridges were struck out.

The **Chairman** remarked that the only question now remaining was as to who should be the arbitrator. He should like to ask Mr. Freeman why he wished to substitute the First Commissioner of Works in place of the Board of Trade.

Mr. **Freeman** replied that Westminster Bridge was under the control of the First Commissioner of Works, and therefore the County Council thought that he should be the arbitrator. Besides, in the question of crossing the bridges artistic and engineering problems would have to be faced, and therefore they would prefer the First Commissioner of Works.

Mr. **Gray**: The Board of Trade see no reason why the appointment of an arbitrator should not be left to them.

The **Chairman** said the Committee had decided to make the arbitrator the Board of Trade.

In answer to the Chairman, Mr. **Freeman** said that he opposed the whole of the opposed clauses of the London County Council.

The enquiry then adjourned.

(*To be continued.*)

NEW PATENTS—1889.

10597. "Improvements in electrical apparatus for lighting gas." H. J. **Griswold**. Dated July 1.

10609. "Improved method of automatic electric signalling on railways." H. S. **Schultess-Young**. Dated July 1.

10640. "Improvements in electric arc lamps." T. P. C. **Crampton** and A. **Essinger**. Dated July 1.

10641. "Improvements in the construction of underground conduits for electric conductors." W. E. **Gray**. Dated July 1.

10678. "Improvements in electric transmitters for telephonic communications. G. A. **Nussbaum**. Dated July 2.

10695. "Improvements in electric batteries." H. H. **Lake**. (Communicated by C. A. Hussey and E. H. Brown, United States.) Dated July 2.

10696. "Improvements in electric batteries." H. H. **Lake**. (Communicated by C. A. Hussey and E. H. Brown, United States.) Dated July 2.

10699. "Apparatus for automatically regulating the potential in the conductors for two or more sets of electrical lamps." **Siemens Brothers** and Co. (Communicated by Siemens and Halske, Germany.) Dated July 2.

10708. "Improved automatic electric cut-out." S. C. C. **Currie**. Dated July 2. (*Complete*).

10709. "Improvements in insulators for electric batteries." S. C. C. **Currie**. Dated July 2. (*Complete*).

10730. "Improvements in apparatus for electric signalling from or to mining or other cages." H. **Cheesman** and R. F. **Cheesman**. Dated July 3.

10744. "An improved process for the manufacture of filaments for electric incandescence or glow lamps." E. **de Pass**. (Communicated by A. de Lodyguine, France.) Dated July 3. (*Complete*).

10775. "An improved exciting liquid for electric batteries." A. **Welcker**. Dated July 3.

10788. "A new or improved recording magnetic compass." J. **Milne**. Dated July 4.

10801. Improvements in electric lamps." H. **Pieper**. Dated July 4.

10814. "Improvements relating to lanterns for electric lamps, and to posts for supporting the same and for similar purposes." R. E.·Keen. Dated July 4. (*Complete*).

10821. "Improvements in or relating to electrical apparatus partly for curative purposes." C. F. Aird. Dated July 4.

10878. "Improvements relating to electric telephones." D. B. Morison. Dated July 5.

10896. "A new and improved form of support for insulators used for electrical purposes." P. Walters. Dated July 6.

10897. "Improvements in the methods of distributing electricity from central stations." T. Parker and E. S. G. Rees. Dated July 6.

10933. "Improvements in secondary electric machines." M. von Dolivo-Dobrowolsky and The Company Allgemeine Elektricitats-Gesellschaft. Dated July 6.

10940. "Improvements in electrical couplings used in electrically lighting railway trains and for other purposes." F. T. Hollins. Dated July 8.

10972. "Improvements in and relating to electric gas lighters." A. E. Clements. Dated July 8.

11018. "Improvements in and relating to electric railways." D. G. Weems. Dated July 9. (*Complete.*)

11019. "Improvements in and relating to electric railways." D. G. Weems. Dated July 9. (*Complete.*)

11032. "Improvements in electric meters, parts of which improvements are applicable to clocks and timepieces." J. Oulton and J. Edmondson. Dated July 9.

11044. "Improvements in storage batteries." W. P. Thompson. (Communicated by P. H. Alexander, United States.) Dated July 9. (*Complete.*)

11046. "Improvements in cores for electrical apparatus, and the method of forming the same." W. P. Thompson. (Communicated by the Westinghouse Electric Company, United States.) Dated July 9.

11049. "Improvements in dynamo-electric machines, in part applicable to electro-motors." J. J. Wood. Dated July 9.

11054. "Improvements in electric fittings." H. T. Lyon. Dated July 9.

11067. "Improvements in insulation for electric conductors." C. T. Snedekor. Dated July 9. (*Complete.*)

11070. "Manufacture of elements or plates for secondary batteries." J. Y. Johnson. (Communicated by A. L. Riker, United States.) Dated July 9.

11075. "Dynamo-electric machines." S. C. C. Currie. Dated July 9. (*Complete.*)

11179. "An electric meter." Siemens Brothers & Co., Limited. (Communicated by the firm of Siemens & Halske, Germany.) Dated July 11.

11191. "Improvements in roses for supporting electric lamps." W. A. S. Benson. Dated July 11.

11242. "Improvements in dynamo-electric, magneto-electric, and electro-dynamic machines." Siemens Brothers & Co., Limited. (Communicated by the firm of Siemens & Halske, Germany.) Dated July 12.

11296. "Improvements in appliances for setting up or taking down electric incandescent lamps." Hon. H. D. Ryder and H. E. Dopson. Dated July 13.

11300. "Improvements relating to the manufacture of illuminating conductors for electric lamps, and to solutions and apparatus for use in such manufacture." H. H. Lake. (Communicated by S. F. van Choate, United.) Dated July 13.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1888.

12858. "Improvements in the distribution of electrical energy." C. Zipernowsky and M. Deri. Dated September 5. 8d. In an electrical installation with alternating current generators, it is of the greatest importance, from an economical point of view, to be able to utilise the motors, electrical machines and apparatus for other purposes besides illuminating purposes; for instance, for driving stationary and movable motors, actuating clocks, telegraph apparatus and the like. The present invention has for its object to comply with this condition in the simplest and most practical manner. 6 claims.

18220. (Under International Convention.) "Improvements in electricity meters or coulomb meters." E. Batault. Dated December 13. 8d. Relates to clockwork mechanism regulated by a pendulum and released by the action of the current; a number of teeth are gathered up proportional to the current strength. 8 claims.

19061. "An improvement in materials to be used in galvanic batteries." A. Cornwell. Dated December 31. 6d. Consists of an improvement upon an invention entitled "Improvements in galvanic batteries and in materials to be used therein," for which letters patent, dated October 16th, 1885, No. 12,378, were granted to one Alexander Schanschieff. Claims:—1. A new article of manufacture consisting of a saline preparation prepared by dissolving the mercuric sulphate in water and adding common salt to it gradually, substantially as described. 2. The process of preparing such solution consisting in the dissolving of the mercuric sulphate in water and adding common salt to it gradually, such mercuric sulphate being preferably prepared in the manner set forth, and the whole process being carried out substantially as described.

1889.

759. "Improvements in switches for electric railways." C. H. Wells. Dated January 15. 8d. In electric railway systems the particular exigencies of the case frequently require that for a portion of its length the same conductor be employed for trolleys supplying motors upon cars travelling in opposite directions. In such case it is obvious that in order for the two oppositely moving trolleys to pass each other without interference, one of them must pass out upon a branch from the main conductor, and that a movable switch must be provided at the point of meeting of said branch and main conductors. The purpose of the invention is to obviate the loss of time and inconvenience consequent upon the use of manually operated switches, by providing a switch of such a character that the trolley or trolleys advancing toward it automatically shift said trolley or trolleys upon one of the branches, said switch also permitting the passage of a trolley or trolleys past it from the other branch, both operations being effected without manual intervention of any kind whatever. 9 claims.

1103. "Improved system of distributing-pipes or conduits for containing the supply conductors for electric lighting." W. Lowrie and C. J. Hall. Dated January 21. 6d. Claims:—1. A system of distributing-pipes or conduits for containing conductors for electric lighting, comprising the combination of a main line of pipes provided at intervals with street boxes, branch pipes leading therefrom having a branch box at the other extremity thereof, and groups of house or separate installation pipes of varying lengths converging upon and connected to the branch lines at the said branch boxes, substantially in the manner and for the purpose shown and described. 2. A system of distributing-pipes or conduits for containing conductors for electric lighting, comprising the combination of a main line of pipes provided at intervals with street boxes, branch pipes leading therefrom having a branch box at the other extremity thereof, a supply or distributing pipe line embracing a small group of separate installation with a short house pipe leading directly therefrom to each installation, substantially in the manner and for the purpose shown and described.

1162. "Improvements in and relating to electric governors for steam or other motive power engines." R. Kennedy. Dated January 22. 8d. Claims:—1. In steam or other motive power engines the combination of a centrifugal governor with a core of soft iron and a solenoid of thick wire in series circuit with a shunt wound dynamo, driven by the engine carrying said governor, substantially as described in reference to and shown in the drawings. 2. In steam or other motive power engines the combination of a centrifugal governor with a core of soft iron, and a solenoid of fine wire in shunt circuit with a constant current dynamo or series wound dynamo driven by said engine, substantially as described in reference to and shown in the drawings. 3. In steam or other motive power engines the combination of a centrifugal governor with a core of soft iron, and a solenoid having a coil of thick wire in series circuit with a shunt wound dynamo, and another coil of wire in shunt circuit with same dynamo driven by said engine, substantially as described in reference to and shown in the drawings.

CORRESPONDENCE.

Barking Road Electric Cars.

On Monday evening a defective driving switch on one of our Barking Road cars short-circuited the battery of accumulators (100 volts) just as the driver, after putting down the passengers at Green Gate, Plaistow, was taking the car on to the stand, previous to leaving for Canning Town. The instantaneous combustion of the insulation of the cable, and evolution of gases from the passage of so great a current, produced an explosion which lifted the seats and shattered the glass of all the windows on each side of the car. No damage was done to the electrical equipment, save the destruction of the insulation of 20 feet of cable (19/18), as it is protected by suitable cut-outs; an additional one has now been put in each car, which will prevent any possible excess of current.

Th. Frazer.

The Electric Traction Company, Limited.

July 24th, 1889.